GAS JOURNAL

LIGHT ⁂ HEAT ⁂ POWER ⁂ BYE-PRODUCTS

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Editorial Notes.

Be Modest—Within Reason.

It will be within the minds of those who heard him, and of "JOURNAL" readers generally, that at one of the luncheons in connection with the recent Joint Gas Conference at the British Industries Fair, Prof. F. W. Burstall, M.Sc., M.A. (Vice-Principal of the University of Birmingham), said that the fault which he had to find with the gas industry was that it was far too modest. If the charge were well founded, the fault, in a commercial age such as the one in which we now live, would not be really so small as might momentarily seem to be the case. No Fairy Godmother would in these days appear at the crucial moment to take Cinderella to the ball. She must bring herself into prominence or must remain "out of the picture," in which case one of the Ugly Sisters would assuredly capture the heart of the Prince (in other words, the customer).

Upon carefully considering the matter, however, we feel that the gas industry can put up a good defence to such a charge. It possesses an organization for propaganda which is the envy of many industries; and it has also other national bodies unceasingly furthering its interests. It is undoubtedly true, as Prof. Burstall declared, that the public want constantly to be told of the goods which the industry has to offer; but so long as the existing spirit of co-operation throughout the industry remains in evidence, there is no reason to fear that the needs of the public in this respect will remain unsatisfied.

The spirit of co-operation to which we refer was demonstrated admirably by the organized section of the gas industry at this year's British Industries Fair. This achievement, there is not the slightest doubt, has had a very definite effect upon the opinion held of the industry, both by its competitors and by other exhibiting industries. Therefore there is every encouragement to repeat, and even increase, the effort at the 1930 Fair. The meeting of the Local and National Committees (under the Chairmanship of Mr. R. B. Hodgson) which is reported elsewhere in this issue, brings to a close the activities of the 1929 Committee; and, in view of a resolution passed at the meeting, we shall hope at an early date to be in a position to publish the names of the new Committee, who will enter upon their labours fortified by a conviction that both gas engineers and appliance manufacturers will give them the same loyal backing that their predecessors enjoyed. This resolution was to the effect that communications should be addressed to the Institution of Gas Engineers, the Society of British Gas Industries, the British Commercial Gas Association, and the National Gas Council, informing them of the Committee's opinion that "the gas industry has definitely benefited by participating in the British Industries Fair as a properly organized section," and of their recommendation that steps be taken to organize a similar section for the 1930 Fair, to the end that a representative Committee be appointed to take over all arrangements.

No one will be surprised at the statement of the Fair Management that the attendance this year was slightly less than in 1928. The only occasion for wonder is that it was not much less, having regard to the unfavourable weather conditions both here and abroad, and to the prevalence of illness throughout the country. Each of these influences was abnormal, and so unlikely to be repeated next year. Therefore we hope no effort will be wanting to ensure adequate representation of the gas industry at the 1930 Fair. It is indeed difficult to over-estimate the good that accrues to the industry in thus placing a well-organized and imposing section before the public and the buyers in other industries; for until every householder and industrial user realizes the possibilities of gas, it will be impossible to secure that extension of business which is the industry's due. Now is none too soon to begin to think of the 1930 British Industries Fair; and once thought of, we hope it will remain in mind throughout the ensuing twelve months. This year's display at Castle Bromwich was a triumph for gas; and it would be a thousand pities to lose any portion of the advantage thus gained through failure to follow it up adequately in connection with next year's show. The date of the 1930 Fair has already been fixed, and will be from Feb. 17 to 28 inclusive; and the 69 firms who exhibited this year, together with the additional ones whom we confidently expect to see represented upon the next occasion, will note that the Hon. Secretary to the Gas Industries Section (Mr. R. J. Rogers) reports already the receipt of a number of applications from manufacturers asking for particulars of space available for 1930, and whether new positions in the section could be allocated to them. It is gratifying to have this proof that enthusiasm over the Gas Section is unlikely to flag.

The preparation of a collective display of this character is in the best of circumstances no mean achievement; in the worst, as represented by the early part of this year, the task is one to tax the biggest resources. In fact, picking one's way round the littered and cheerless exhibition building on the days immediately preceding the official opening, one marvelled at the manner in which, handicapped as they were by the abnormal weather and sickness conditions, the exhibitors and the officers and men of the Birmingham Gas Department struggled through to success. The vote of thanks passed to Mr. Rogers at the Committee meeting was well deserved.

Modern Horizontals.

In a paper before the Southern Association of Gas Engineers and Managers last week, Mr. F. Blackburn explained why at Devonport they recently decided to instal carbonizing plant of the modern horizontal (Dempster-Toogood) type. In the first place, coal handling is cheap; secondly, the plant could be erected in an existing retort house; thirdly, the local coke market is largely industrial, and is sustained by horizontal coke. Hence, wisely, thermal efficiency was sacrificed to commercial efficiency—the final aim of all gas engineers. Regarding the plant itself, there are several interesting features. "Dempster-Toogood" descension pipes replace the common ascension pipes; the main arch has been substituted by a simple flat dead-weight bench cover; and 95 p.ct. silica beds alternate with moulded siliceous (84 p.ct. silica) beds and a moulded fireclay bed—the idea being to gain continuous experience of all materials during the summer and winter loads. Whether this is the best manner in which to assess the relative merits of the different materials may be open to question, and for this reason we look forward to Mr. Blackburn's future observations on the subject, when two or three years' working of the setting permit of conclusions being drawn.

The paper and the ensuing discussion are published in our columns to-day, and will be read with interest. We call attention to two of the questions discussed—first, the merits and demerits of descension pipes; secondly, the sense of wonderment expressed regarding Mr. Blackburn's statement that the fuel consumption of the setting is less than 10 lbs. of coke per 100 lbs. of coal carbonized. In respect of the latter, the author anticipates that, if 10-hourly charges replaced the present 12-hourly system, this low figure would still further be reduced by 10 p.ct., which economy, combined with postponement of capital expenditure for extension, would, in his opinion, more than pay for the additional staff.

As for the pros and cons of descension pipes, Mr. W. H. Warren (Gas Light and Coke Company), who has had considerable experience of them, mentioned that their use permits of the equalization of the vacuum on the different tiers of retorts, which equalization—important because it enables one to keep at an extraordinarily low figure the inert content of the gas—is impossible with the ordinary system of ascension pipes. Mr. R. Robertson (Bristol) referred to the liability of stiff emulsions to form at the foot of descension pipes, and Mr. A. H. Andrews (South Metropolitan Gas Company) to the difficulty of actuating the valves by wrought-iron or steel fittings, which in the circumstances have a short life.

Improvement in London Air.

In many respects life in London gets more difficult as the years pass; but in some directions at any rate a vast improvement has taken place, and among the chief of these must be placed the greater purity of the air. Older people can recall the times when, for days at a stretch, the Metropolis was subjected to what was known as a "London particular." On the occasions of these visitations, persons groped their way about, coughing and spluttering, with their eyes smarting and their heads splitting; omnibus and cab drivers led their horses, and at the worst left them in the stables; and the less venturesome of the people who had to be abroad provided themselves with hand lanterns. True, we have fogs now, and our geographical position makes it unlikely that they will ever entirely be got rid of; but how different they are from those of yore. How thankful would the sufferers of thirty or forty years ago have been could they have exchanged what is now regarded as a "bad fog" for the smothering pall which then inflicted itself upon them.

Though there are so many others, this purifying of the air must always be regarded as the greatest of the benefits that the use of smokeless fuel can confer upon humanity. The gain from a health point of view has been incalculable; and damage to property has been enormously lessened. Writing to "The Times" last week, Dr. J. S. Haldane testified from personal observation to the very great improvement that has taken place in London air; and he pointed out that this improvement is clearly due to the substitution of gas and coke fires for open coal fires. To Dr. Haldane it appears that it is only through the use of fuel in the form of purified gas that we can look for a practical remedy for the troubles due to sulphuric acid in the air. Electricity, of course, is out of the running, "so long as the generating stations are within the area of a town, or near to it."

Dr. Haldane's letter was called forth by a leading article in "The Times" in which allusion was also made to carbon monoxide; and his reference to this will be noted with interest, and may well be borne in mind: "It is only "in the case of streets crowded with motor cars that the "proportion [of carbon monoxide] in the general air may "become physiologically significant. Motor vehicles are "now probably the main source of carbon monoxide in the "atmosphere of a town."

Views on American Gas Practice.

"Speaking broadly," observed Mr. S. G. Watson, of Messrs. W. C. Holmes & Co., Ltd., before the London and Southern District Junior Gas Association last Friday, "there is fundamentally a great deal in common between American and British gas practice. We may differ somewhat in detail in the secondary and subsidiary processes in gas manufacture, but essentially we have the same problems." Recently Mr. Watson has investigated at first hand, and in detail, the various phases of gas-works practice in the United States; and the foregoing quotation is from a paper entitled "Observations on American Gas Engineering Practice," the first part of which will be found in later columns of to-day's "Journal." It is a statement with which we have long been in agreement, and it lends further justification to our continued endeavour to keep our readers in touch with developments in gas manufacture in America.

Mr. Watson's survey is comprehensive, and it is difficult to single out any one particular as being of greater interest than another. At the present time, however, when largely increased demands for "statutory" gas are causing considerable anxiety to those responsible for production on cramped sites, or to those whose incidence of capital is already high, the author's remarks on the purification of gas from sulphuretted hydrogen by liquid processes will undoubtedly attract attention. These processes, as is well known, have the great advantage of requiring less ground space than is necessary for the usual installations of oxide boxes; and that they have long since passed the theoretical stage is indicated by the fact that there are now over sixty plants where liquid purification is in use, treating over 500 million c.ft. of gas per day.

As for the "Seabord" system, the operating cost of which (including the removal of hydrocyanic acid) is about ¼d. per 1000 c.ft. of gas treated, this is impracticable in England since legislation forbids the discharge of sulphuretted hydrogen into the atmosphere, and limits that of sulphur dioxide. But there are several others, such as the "Ferrox," the "Nickel," and the "Thylox," which in the author's opinion may have possibilities for us, more particularly in regard to congested works. It seems that Mr. Watson did not encounter any attempted application of the activated carbon process of gas sulphur removal, which was described in detail in the "Journal" for Nov. 21 last. The plant then dealt with was installed at Recklinghausen; and in this case also the ground space occupied is small in relation to the quantity of gas treated. Moreover, the cost of this process compares favourably with that of oxide purification.

The author's observations on the growing popularity of the "Connersville" type of meter, on the differences between cooling, condensation, and exhausting practice as carried out in this country and America, on a new Koppers plant for dephenolating ammoniacal liquor, and on the methods of ammonia recovery practised in the States will be read with interest. In regard to the direct system of ammonia recovery, Mr. Watson mentions that it is customary to find on large works saturators built in single units treating 20 to 30 million c.ft. of gas per day, and that the saturators are now placed in the open, thus effecting considerable savings. Finally, we call attention

to the care which the American carbonizing industry pays to the production of a uniform and satisfactory coke for both industrial and domestic purposes. The competitive demand in America is for a coke of high density, structural strength, and slow combustibility; and this in part explains why, in general, America carbonizes her coal in coke ovens. In this connection Mr. Watson's tabulated description of three typical coke oven installations, all of which dispose of their gas to gas companies for distribution, will be found of value.

Chief Gas Engineer for Manchester.

It will be noticed from our advertisement columns to-day that the Corporation of Manchester invite applications for the position of Chief Engineer of the Gas Department, at a salary of £2250 per annum.

Gas Undertakings Bill—Important New Clause.

The Report Stage of the Gas Undertakings Bill was taken in the House of Lords on March 21. An amendment by Lord Banbury of Southam to protect the rights of the existing mortgagees and debenture holders was withdrawn after an assurance from the Lord Chancellor that it was unnecessary. An amendment moved by the Marquess of Reading, on behalf of Lord Melchett, to extend the powers of gas undertakings to purchase residual products, was accepted by the Government and adopted. A Government amendment to protect the position of railway companies with regard to the breaking-up of roads was adopted. The Third Reading of the Bill was taken on March 25. It was originally intended to take its preliminary stages in the Commons yesterday, but these have now been postponed till after Easter.

Too Many Technical Societies?

At two recent dinners of technical societies we have heard the opinion expressed that there are too many of these organizations; but this evidently is not the view of Sir Alexander Gibb, G.B.E., C.B., who, in his Presidential Address last week to the Institution of Chemical Engineers, expressed the view that, though there must be a considerable wastage of energy, and a retardation of progress, caused by the almost haphazard dissemination of effort over the growing multitude of the chemical institutions and societies, there is a very definite and indisputable need for most, if not all, of these organizations. He feels that the value of small and specialized technical institutions is not always fully appreciated by the older and larger societies. The problem therefore, as he sees it, is not the reduction of the existing number of organizations, and the prevention of further increase, but to find the best way to satisfy the different individual interests, and at the same time secure all the advantages that lie in co-operation. Sometimes, in our special position, we are inclined to think that there are rather a lot of technical societies connected with the gas industry; but we should find it hard indeed to point to one that is superfluous.

Apportioning the Blame.

From time to time keen controversy has arisen over the pollution of streams; and there has been a tendency in certain quarters to blame tar for this, both in season and out of season. There has lately been less heard of this; but a fresh outbreak of "tarphobia" may take place at some time or other; and it may be useful to keep a "shot in the locker" against such a contingency as a renewed attack upon an industry which is of great national importance. Such a weapon of defence is provided in our "Correspondence" column today, where Mr. J. R. Bradshaw, B.Sc.Eng.(Lond.), Engineer, Manager, and Secretary of the Hartlepool Gas and Water Company, shows that pollution from liquid manure is a very likely cause of fish poisoning. The evidence he quotes is taken from the "Fishing Gazette," and is of such a nature that it is hardly likely to be challenged. As Mr. Bradshaw says, there must be very few fishing streams which are not subject to the leakage of liquid manure from adjacent farms; and therefore the point is one that must be kept in mind by those who are interested in the use of British tar on British roads.

SOCIETY OF BRITISH GAS INDUSTRIES.

Council Meeting.

A Meeting of the Council was held on Thursday, March 21, at 56, Victoria Street, Westminster, when there were present: Mr. R. J. Milbourne (Chairman), Mr. C. A. Goodall (Vice-Chairman), Messrs. A. B. Balmford, G. Clark, S. Cutler, F. Dobson, G. Ewart, E. J. Fox, D. M. Gibb, F. J. Gould, G. J. Jackson, J. W. Scott, C. R. F. Threlfall, B. B. Waller, Ernest West, Frank West, Dr. E. W. Smith (Hon. Treasurer), Mr. E. J. Davison (Hon. Secretary), and Mr. Arthur L. Griffith (Secretary).

Apologies for absence were reported from Messrs. T. A. Braddock, R. B. Hodgson, A. H. Lymn, and Col. E. A. Wilson.

The following firms have been elected Members of the Society: Falk, Stadelmann, & Co., Ltd., London, Section 7; and Broadhead Constructions, Ltd., Manchester, Sections 1, 2, and 4.

BRITISH INDUSTRIES FAIR, BIRMINGHAM.

It was decided that the Society shall organize a Gas Industries Section at the British Industries Fair, 1930, on similar lines to this year, and invite the co-operation of the other bodies in the industry.

The Annual General Meeting was fixed for Tuesday, April 30, at the Hotel Metropole, Northumberland Avenue, W.C., when the President, Lord Hartington, will give his Address. The Annual Dinner will be held in the evening.

It was announced that Lord Cecil of Chelwood has accepted the Presidency of the Society for the ensuing year.

The following were nominated as officers for 1929-30:

Chairman.—Mr. C. A. Goodall.
Vice-Chairman.—Mr. Frank West.
Hon. Treasurer.—Dr. E. W. Smith.
Hon. Secretary.—Mr. E. J. Davison.

Mr. F. C. Tilley was nominated as an Elective Member of the Council.

The Council's Report for the Annual Meeting was approved.

FORTHCOMING ENGAGEMENTS.

April 6.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Annual General Meeting and closing address by Mr. C. S. Shapley, at the Royal Technical College, Glasgow.

April 6.—WESTERN JUNIOR GAS ASSOCIATION.—Annual General Meeting. Presidential Address.

April 12.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Spring Meeting at Alloa.

April 13.—WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.—Annual General Meeting at Newport.

April 13.—MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.—Annual Dinner and Social. Paper by Mr. S. L. Wright, Colne, on "Hydraulic Mains—Theory and Practice."

April 13.—SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).—Meeting and visit to Galashiels Gas-Works.

April 13.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to Works of Lea Bridge District Gas Company.

April 18.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting at Birmingham. Paper by Mr. F. J. Bengough on "Heat Control on Continuous Vertical Retorts."

April 20.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to Motherwell and Wishaw Gas-Works.

April 20.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting at Sheffield. Visit to the Orgreave Coke Oven Plant.

April 30.—SOCIETY OF BRITISH GAS INDUSTRIES.—Annual General Meeting at the Hotel Metropole, Northumberland Avenue, W.C.

May 1 and 2.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Spring Meeting at the Hotel Cecil, London.

May 10.—BRITISH COMMERCIAL GAS ASSOCIATION.—Manchester District Conference at Southport.

May 10.—SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Visit to Exmouth.

May 16.—MIDLAND ASSOCIATION OF GAS ENGINEERS.—Visit to Shrewsbury.

May 16.—WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.—Meeting at Cardiff.

May 24.—NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.—Annual Meeting.

Sept. 12.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Annual Meeting at St. Andrews.

INSTITUTION OF GAS ENGINEERS.

April 9.—Gas Education Committee at the University of Leeds, 2.30 p.m.

April 10.—Executive Committee of Council, 11 a.m.; Finance Committee, 11.30 a.m.; Benevolent Fund Committee of Management, 12 noon.

PERSONAL.

His many friends in the industry will be interested to learn that Mr. CHARLES W. BRAINE, F.C.I.S., will retire on March 31 from the office of Secretary of the Wandsworth, Wimbledon, and Epsom District Gas Company, as announced by the Chairman at the recent general meeting of the Company. Mr. Braine is, however, retained by the Company as Consulting Secretary. The Directors have appointed as Secretary Mr. W. H. Cromarty, A.C.I.S. (the Rental Superintendent). Other duties in regard to which Mr. Braine was immediately responsible to the Board devolve, as at present, upon Mr. G. M. WILLMOTT, F.C.I.S. (Assistant Secretary and Registrar), and Mr. L. BATES, A.C.I.S. (Accountant).

Mr. A. D. YOUNG, Chief Engineering Assistant to the Burnley Gas Department, has been appointed to the staff of Messrs. Newton Chambers & Co., Ltd. Mr. Young entered the service of the Burnley Corporation nine years ago, and during four years, in addition to his other duties, has been responsible to the Gas Engineer for the design of the new Oswald Street Gas-Works. He received his early training under Mr. J. W. Morrison, M.Inst.C.E., the late Chief Engineer to the Sheffield Gas Company.

OBITUARY.

The death has occurred at Sunderland, in his 93rd year, of Mr. JAMES WHYTE, who was Manager of the Seaham Gas and Lighting Company for 47 years. He was a native of Kirriemuir, Forfarshire, and was Manager of the Gas-Works at Banchory, Aberdeenshire, and then at Kinross and Lanark, before becoming Manager at Seaham Harbour—a position which he held from 1873 until his retirement in 1920. He was one of the founders of the North of England Gas Managers' Association over 50 years ago, and was President of the Association in 1892. He was also a life member of the North British Association of Gas Managers. He leaves one daughter and one son, the latter being Manager of the Seaham Gas-Works, in succession to his father.

The death occurred recently, in Paris, of Dr. PAUL DVORKOVITZ, a pioneer of the petroleum industry and a renowned scientific research worker. In 1921 he began to devote himself to the low-temperature carbonization of coal, the possibilities of which he had outlined in a lecture before the Society of Chemical Industry as early as 1893. The Motor Fuel Proprietary Company was formed to work his process at Slough.

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

DULL conditions continue on the Stock Exchange. There was slightly more animation at the beginning of last week, influenced doubtless by the big inflow of gold, but the improvement was not maintained. There was a paucity of buyers in the gilt-edged market, and dealers in consequence were unwilling to add to their commitments.

The Industrial and Miscellaneous markets were no exception to the general rule; and though there were a few bright spots in the base-metal section of the Mining Market, business was on a very reduced scale.

The feature of the Gas Market was the drop of 15 points in the Imperial Continental capital stock to 375-395. A change in quotation that one does not often see is the increase of 1 point in the Hastings two stocks on an *ex* div. variation. Rumour is rife again with regard to another foreign company; the Montevideo stock being marked up 3 points.

A study of the stock and share list shows that prices generally are well maintained; and where values are low, it can be taken for granted that there have been few, if any, transactions. It is interesting to note that though no transactions were recorded during the week in the North Middlesex 6 p.c. consolidated, the stock has justifiably been marked up 5 points.

The following transactions were recorded during the week:

MONDAY.—Alliance and Dublin, 100¼, Commercial 98, Continental Union 126, Croydon max. div. 85½, European 20⅜, 20¼, 20½, 20⅜, Gas Light and Coke 18s. 10½d., 19s., 19s. 1½d., 19s. 3d., 3½ p.c. 65, 4 p.c. pref. 76½, 77, 3 p.c. deb. 59, 59¼, Imperial Continental 394, 395, 396, 397, 398, 400, 402, Newcastle 3½ p.c. 17s. 1½d., 17s. 3d., Primitiva 31s. 3d., 31s. 4½d., 31s. 6d., 32s., 32s. 1½d., 32s. 3d., 32s. 6d., South Metropolitan 106¾, 107, 107¼, 6 p.c. pref. 100¼, Swansea 7 p.c. pref. 101, Tottenham 3½ p.c. 102⅜. Supplementary prices, Tottenham 5 p.c. pref. 91½, 5 p.c. mort. 97, Ventnor 10 p.c. 19½, Yorktown new 5 p.c. pref. 92.

TUESDAY.—Alliance and Dublin 100⅜, British 120¼, 5 p.c. deb. 95, Continental Union 126, 7 p.c. pref. 126, European 19½, 19⅜, 20, 20 1/16, 20⅛, 20¼, Gas Light and Coke 18s. 10½d., 19s. 1½d., 3½ p.c. 65, 4 p.c. pref. 76, 77, 3 p.c. deb. 59¼, Imperial Continental 395, 396, 399, Maidstone 5 p.c. 128½, Portsmouth 4 p.c. 117¾, Primitiva 31s. 3d., 31s. 6d., 32s. 3d., South Metropolitan 106¼, 3 p.c. deb. 58½, South Suburban 5 p.c. deb. 98, Wandsworth, Wimbledon stock, 117. Supplementary prices, Brighton and Hove 5 p.c. deb. 95½, Eastbourne "B" 104¼.

WEDNESDAY.—Bournemouth 6 p.c. pref. 10⅞, British 5 p.c. deb. 95, Continental Union, 123, 125, 126, European 19⅝, 19⅞, 20, 20⅛, Gas Light and Coke 18s. 10½d., 19s., 19s. 1½d., 3½ p.c. 64, 64¼, 65, 5 p.c. deb. 101¼, Imperial Continental 390, 392, 394, 395, Montevideo 107, Primitiva 31s. 3d., 31s. 7½d., 31s. 9d., 32s., 32s. 3d., South Metropolitan 106¼, 106¾, 107¼, South Suburban 5 p.c. deb. 99, Tottenham 3½ p.c. 102½, 102⅜, Wandsworth, Wimbledon stock 119. Supplementary prices, Barnet 4 p.c. deb. 76, Southgate 7 p.c. max. 111, 111½, Yorktown new 5 p.c. pref. 92.

THURSDAY.—Alliance and Dublin 99⅜, 99⅝, British 5 p.c. deb. 95, Cardiff 7½ p.c. deb. 102⅝, 103, Commercial 98, 98½, Continental Union 123, 124½, 125, European 19, 19⅛, 19¼, 19⅜, 19¾, *ex* div., Gas Light and Coke 18s. 10½d., 19s. 1½d., 3½ p.c. max. 64, 5 p.c. deb. 101¼, Imperial Continental 385, 388, 390, 391, 392, Primitiva 31s., 31s. 1½d., 31s. 3d., 31s. 6d., 31s. 10½d., 32s., South African 90s., South Metropolitan 106¼, 106⅞, Tottenham 3½ p.c. 104½, 4 p.c. deb. 79, Wandsworth, Wimbledon 5 p.c. 117½, 118½, new 104, 105, 4 p.c. deb. 78½, 79. Supplementary prices, Romford original 11¼, South Suburban 7 p.c. deb. 99¾, Yorktown (Camberley) new 5 p.c. pref. 92.

FRIDAY.—Alliance and Dublin 100⅜, Bournemouth 6 p.c. pref. 10⅞, British 5 p.c. deb. 95, Continental Union 123½, 125½, 7 p.c. pref. 126, European 18½, 18⅝, 18¾, 19, 19⅛, Gas Light and Coke 18s. 10½d., 19s. 1½d., Hastings 3½ p.c. 80, 80½, Imperial Continental 379, 380, 381, 382, 384, 385, Primitiva 31s., 31s. 6d., 31s. 9d., 4 p.c. con. deb. 79, 80, South Metropolitan 106½, Swansea 7 p.c. pref. 101, Wandsworth, Wimbledon 5 p.c. stock, 120. Supplementary prices, Woking District new additional "B" 108½, 109.

In Lombard Street at the close of the week loanable credits were plentiful, and both old and new loans were obtainable at 4½ p.c. down to 4 p.c. for balances. Treasury Bills were allotted at £5 5s. 1·71d., being 1s. 7½d. below the previous week's rate, and rather lower than was generally expected.

NOTES ON NEW BOOKS.

CARBONIZATION TECHNOLOGY AND ENGINEERING.

Reviewed by T. CAMPBELL FINLAYSON, M.Sc.

During the past few years carbonization technology has shown considerable progress. So many processes have been developed, new engineering devices perfected, and theories propounded, that it is difficult for anyone to keep up to date. When, therefore, a new book appears on the subject of carbonization technology,* and it is stated to be "a practical exposition of the processes employed for the carbonization of coal and wood by high and low temperature methods, with an account of the bye-products obtained," one turns to it eagerly in the hope that it will give a survey of recent progress. In his introduction, the author states that his forty years' experience have given him unique opportunities of studying coal carbonization, and he therefore has endeavoured to place the knowledge gained in as concise a manner as possible, treating the subject from an engineering point of view. In a practical treatise such as the one under consideration, however, the reader is justified in assuming that the author will, in the selection of his matter, have studied the pages of the Technical Press; and if Mr. Armstrong had closely followed the pages of the "JOURNAL" and its contemporaries during the past five years, it is difficult to see how the book would have appeared in its present form.

The opening chapter gives a short general statement on the subject of the constitution of coal. The second chapter deals

*"Carbonization Technology and Engineering," by John Armstrong. Published by Messrs. Charles Griffin & Co., Ltd., 42, Drury Lane, London, W.C. 2; 1929. Price, 36s. net.

with refractory materials, where, in the opening paragraphs, one reads that fireclay has been, and still is, the chief material for the purpose of coke oven construction. This statement probably accounts for the fact that, in a chapter extending through 37 pages, silica bricks are dealt with in one page. It would be interesting to know how many coke oven plants, or even other types of high-temperature carbonization plants, have been built of fireclay during the past five years. The preparation of coal is dealt with in the third chapter; methods of handling and coal washing being discussed. Dry cleaning processes are dismissed as having been tried "with little or no success." This, again, will cause surprise, in view of the extensive developments in the dry cleaning of coal both in America and this country during the past two or three years. In the same chapter the author states that the old method of top charging has been superseded by stamping, and shows details of stamping machinery Once more, it would be interesting to know how many ovens with stamped charging machinery have been constructed during the past five years. With the modern ovens, top charging is the general practice.

The author next devotes a chapter to the theory of coking. Discussing the time occupied in the carbonization of coal, he states that modern ovens take from 24 to 36 hours. One would have thought the more usual figure was 12 to 18 hours. Later it is stated that "the best coke requires time for its formation, together with a high temperature, and, for the purpose of making this hard coke, narrow ovens are useless." This statement does not seem quite in agreement with the experiences, especially of America and Germany, in modern narrow ovens. Three chapters are given up to a discussion of carbonization in coke ovens. The development from beehive to bye-product ovens is traced. The descriptive matter is well illustrated by a large number of plates. Here again it must be submitted that the information is incomplete. At least four systems of modern ovens, which are occupying considerable attention at the present day, and upon which there is plenty of published information, are not even mentioned—viz., Becker, Kogag, Still, and Wilputte. Chapter eleven deals with the recovery of bye-products in the coal carbonization process. This is probably the most valuable section of the book. The various systems employed for bye-product recovery are explained and illustrated by a number of diagrams.

Gas manufacture is discussed in a chapter occupying some 50 pages. It is a difficult and almost an impossible task to cover such a subject in so short a space; but by careful selection of matter, it should have been possible to give a picture of modern gas-works carbonizing practice. In any case, the very shortage of space should ensure that the selected material was accurate and up-to-date; but this is not the case. For example, the information on continuous vertical retorts is some years behind the times. No reference is made to recent developments in either the Glover-West or the Woodall-Duckham systems. Fig. 242, the only illustration referring to heating arrangements, depicts the old type Glover-West system, and is labelled "Vertical Section and Plan of 'Duckham' Retort." Turning to chamber carbonization, the author discusses and illustrates the installation of horizontal chamber ovens at the Saltley Gas-Works. This is somewhat out of date, as the plant has been scrapped and dismantled. Plate 271, entitled "Sectional Elevation through Ovens and Heating Flues (Saltley Gas-Works, Birmingham)," depicts some type of regenerative continuous vertical chamber oven which has certainly not been erected at Saltley.

The chapter on low-temperature carbonization contains a description of the retorts developed by Low-Temperature Carbonisation, Ltd., Lamplough, and Tozer, and a long extract from the report of the Fuel Research Board, giving an account of their work on low-temperature carbonization to December, 1926. Mention is made that a plant is to be built at the Richmond Works of the Gas Light and Coke Company, and that "details of the plant are now being worked out." It was stated in the Press some little time ago that the plant was built, and is now, in fact, in operation. The author concludes with a general chapter on the "Economic Combustion of Fuel."

To sum up, the book is disappointing. It does not present a picture of modern carbonization technique. By far the greater portion of it represents the views of 1918, rather than of 1929. In addition, the value of a book as a treatise for reference is reduced by a number of inaccurate statements.

AUSTRALIAN IMPRESSIONS OF SIR ARTHUR DUCKHAM, K.C.B.

Sir Arthur Duckham, K.C.B., Leader of the Economic Mission to Australia, landed in England on Saturday last, after an absence of seven months.

No better indication of the success of this Mission can be obtained than by perusal of the Australian Press. The Melbourne "Argus," writing of the Report published by the Mission, stated that "Sir Arthur Duckham and his three colleagues have performed with conspicuous ability and courage the task which they were invited to Australia to perform. With no interest to serve, with no sections to placate, with no preconceptions to cloud their judgment, they have told the truth as their business training has enabled them to see it; and their summary of Australia's ills and their suggested remedies is as penetrating and candid as it is perspicuous." Probably that statement may be taken as representing Australia's opinion of the work of the Mission.

Before Sir Arthur left Melbourne, a meeting was held at the Town Hall on Wednesday, Jan. 16, when an address was presented to him expressing the appreciation of all the leading organizations in Australia to the Mission for their work. In his reply on that occasion Sir Arthur stated: "We all feel proud of Australia and its 98 p.ct. British stock. We realize what the pioneers have done, and we believe that that same pioneering spirit still exists and will carry Australia through her troubles onward to a development worthy of her resources and the Empire of which she forms so important a part."

In the course of an interview at Southampton on Saturday, Sir Arthur stated: "The whole seven months' trip has been full of occasions for gaining knowledge and fresh points of view. Until I travelled round the world by the All-Red Route, I had but the smallest appreciation of the Empire's significance. We found no "Jingoism," no flag-flapping throughout our journey, but everywhere was the pride of association with the Mother Country. The Dominions provide space for the expansion of our race. Their wide acres ensure the provision of food and raw materials for such increase of population as can at present be envisaged. I am now more than ever a believer in the economic duty of the Empire. Our investigation has shown that there is much to be done by the rationalization of our economic forces. Trade within the Empire must be fostered. In addition, trade by the Empire with the world must be considered on the widest basis. The home country, the Dominions, and the Colonies must appreciate each other's economic problems, and must take action for the good of the whole rather than for the good of any integral part. I trust that the work of the next Empire Economic Conference may be carried through on those broad lines, and I am certain that Australia is willing and anxious to play her part. She realizes what the Empire means to herself, and she is willing to co-operate in order to strengthen the whole structure. In every part of the Commonwealth we were cordially received, and we were met with the utmost frankness. Our report has been accepted by all in the same spirit as that in which it was prepared, and I am certain that the many friends we met will hold us in the same esteem as we hold them."

Sir Arthur McD. Duckham, K.C.B.

DINNER OF THE INSTITUTION OF CHEMICAL ENGINEERS.

The photograph shows some only of the large number of members and guests who attended the Seventh Annual Dinner of the Institution of Chemical Engineers, which took place at Grosvenor House, London, W., on Wednesday last—the President, Sir ALEXANDER GIBB, G.B.E., C.B., in the chair. One and all spent a thoroughly enjoyable evening, with music and speeches—the latter, by the way, devoted largely to explaining what is a chemical engineer. The toast of "The Institution" was submitted by the Right Hon. Viscount Chelmsford, G.C.S.I., G.C.M.G., G.C.I.E., G.B.E. (Chairman of the College Committee, University College, London), who declared that industry was "hitching its wagon" to the chemical engineer, who seemed to be the one man that the whole of industry was after. The President, in response, acknowledged the invaluable help given by Viscount Chelmsford in the education of the chemical engineer. The Institution, he said, was prosperous, and steadily increasing in numbers. The toast of "Kindred Institutions" was proposed by the Vice-President (Mr. W. A. S. Calder), and replied to by Prof. Jocelyn F. Thorpe, C.B.E., F.R.S. (President of the Chemical Society), and Dr. Herbert Levinstein (Chairman of Council of the Society of Chemical Industry). Dr. Levinstein expressed the opinion that it would be a good thing if, instead of a number of Societies, there was a single large Institution housed in a single building. The health of the President was enthusiastically drunk at the call of Mr. J. Arthur Reavell (President-Elect), who said that Sir Alexander Gibb had done an enormous amount of work for the country in times both of war and of peace.

MODERN HORIZONTALS AT DEVONPORT.

By F. BLACKBURN, Assoc.M.Inst.C.E., A.M.I.Mech.E., of Devonport.

[Before the Southern Association of Gas Engineers and Managers.]

Whenever a new carbonizing plant is being considered, one naturally looks to the latest methods, and the mind immediately thinks of verticals in one form or another. Devonport was no exception to the rule, but after carefully considering the position of the Works locally, and geographically with regard to the coalfields, and the adaption of the existing conditions, coupled with the cost of a new plant, it was decided that the most modern type of horizontals should be installed.

REASONS FOR ADOPTING HORIZONTALS.

Our Works are situated close to the sea, and the cost of handling coal into our coal stores from a collier at our wharf is very much cheaper than from the railway. Our coal is all sea-borne Durham, which is strongly caking and of too high a slack-coal content to be as desirable for continuous vertical retorts as for horizontals. The retort house was existing, of the curved station roof span type, and was replete with stoking machinery, telpherage, coal-handling plant, and stage floors, all of which could be easily adapted into any scheme without serious modification, thereby obviating considerable capital expenditure, if the principle of horizontals were selected.

It is singular that during recent years, in spite of the fact that the new forms of carbonization have been so much in evidence, it has passed almost unnoticed that horizontal retorting has formed the subject matter of the majority of papers on carbonization before the Institution of Gas Engineers. The effect of these papers has been to bring out and establish the decisive effect of residuals, particularly coke, in reducing on balance the net cost of the coal, and thereby producing cheap therms into the holder.

Added to the above reasoning, our coke market is largely for industrial purposes, which has been fed and sustained by horizontal coke; you therefore have very briefly our deliberations which led up to the installing of the new plant at Devonport.

The space available had a frontage of 99 ft., and contained 8 beds of 8's, that is 64 retorts, 23 in. by 16 in. by 20 ft. long. The new bench contains 9 beds of 10's, 10 ft. centres, or 90 retorts, 24 in. by 18 in. by 22 ft. 6 in. long; the new bench has therefore twice the capacity of the old one standing on precisely the same site, which demonstrates the remarkable saving of ground space.

UNUSUAL LINES.

The new installation, to use the words of our President when inviting me to submit a paper, is on rather unusual lines; in fact, there are so many interesting departures from the usual practice that I fear that in aiming for brevity I may miss the goal of satisfactorily describing the plant.

The retort bench is chiefly characterized by two outstanding features:

(1) The realization that hot ascension pipes were the *bête noire* of the retort house, and the substitution of the "Dempster-Toogood" patent descension (scrubber) pipes.

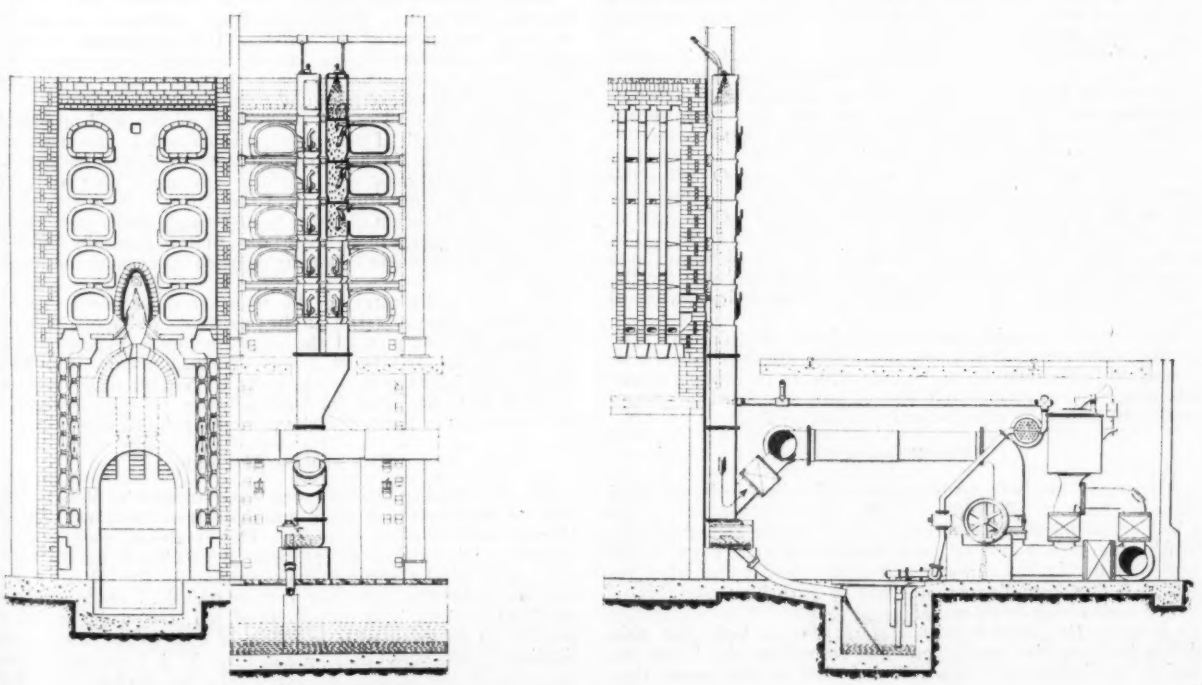
(2) The recognition of the impracticability of accommodating the relative expansion and growth of silica and firebrick under a main arch, the abandonment of the main arch, and the substitution of a simple flat dead-weight bench cover of economic construction to accommodate automatically the relative expansions.

Each descension (scrubber) pipe is in valved communication with 5 retorts, and as each retort is in a different stage of distillation, it is obvious that the condition in the interior of each pipe is considerably more constant as regards both temperature and regularity of volume flowing. Down each pipe is maintained a fall of atomized liquor which scrubs the hot crude gas and assists the early throwing down of tar before the gas is sufficiently cool to condense out the ammoniacal liquor, with advantage to the bye-products. To assist in the cooling of the crude gas, the descension pipes are carried into the relatively cool cellar away from the heated brickwork. The cellar contains the foul and tar mains and retort house governors, so that we have a unique feature in horizontal practice—a bench-top freed from all mountings.

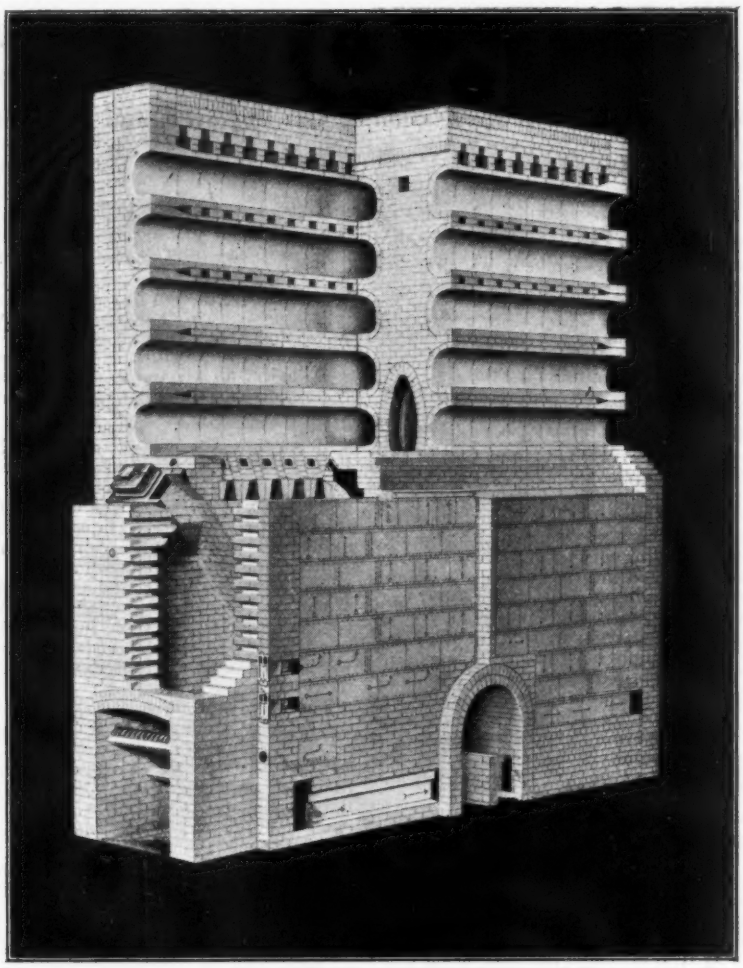
The sprays of liquor are continuously maintained, and the same liquor is re-circulated by the duplicate pumps, its temperature being prevented from rising above a predetermined limit by a cooler; the water to the boiler feeds passing through the cooler to carry off and utilize the surplus heat. The gas at the retort house governor is at such temperature that the re-circulated liquor does not condense out the free ammonia.

The off-take valve of the descension pipes is of the mushroom type, pivoted to be easily ground to its seat *in situ*; the spring loading of the valve holds it firmly in either the open or closed positions. In the open position the valve is washed and kept cool throughout the 12-hour carbonizing period by the descending spray. The valve seat is on the mouthpiece itself so that there are no branches to auger. The descension pipe terminates in a seal-pot in the cellar, and the gas stream reverses direction immediately over the seal-pot. Any solid particles are to a large extent precipitated where they can be most easily cleared. The seal-pots are cleaned each shift, and approximately 10 lbs. of solid matter is removed, and it is of interest that we have yet to have our first stopped pipe. The surplus tar and liquor from the retort house tank is removed each shift by the tar pump (in duplicate) to the yard underground storage tanks.

The flat insulated dead-weight bench cover by its obvious



DEMPSTER-TOOGOOD MODERNIZED HORIZONTALS AT DEVONPORT.



DIAGRAMMATIC SKETCH OF SETTING.

simplicity is self explanatory. It exactly allows for growth and expansion, and in working has given rise to most favourable comment. The total expansion upwards was 1¾ in., and horizontally over the whole length of the bench 2¾ in. The elongation of the bench is thus overcome, there being no sustained thrust from main arches. In passing, attention is called to the elongation of the old bench. The thrust of the main arches of the setting had actually in course of time crumpled up the end arches to the extent of 12 in. each, thus making them totally unsafe for further use.

The new bench is paved with porous insulating brick to conserve fuel, and is clear of all bench mountings. The reduced height of the bench brickwork and the absence of arch bricks illustrates the effected economy, and we have often heard "Why has not so obvious an advantage been applied before?"

The producer is of deep design, having the definite object of a constant depth of fuel. The curtain wall made possible the introduction of producer gas dampers to control definitely the fire at the back, and thereby save the expense of the door to ash pan and primary air slides, and simplified control. The grate, which is fully open to the atmosphere, is of the inclined non-clinkering screen bar type, which offers no ledge for the coke in the primary zone of combustion to impede its downward travel.

The furnace charging doors are of interesting design. The sealing faces never lose contact whether the door is open or closed, thus warping of the sliding door is prevented, to the advantage of working, and the 2 cwt. insulated door can readily be moved by a single pull of about 30 lbs.

The Retorts.

The retorts are built up of 95 p.ct. silica in 6 beds, moulded siliceous 84 p.ct. silica for 2 beds, and moulded fireclay in 1 bed. The silica beds alternate with the other beds down the bench, the idea being to gain continuous experience of all materials during the summer and winter loads; and when resetting is due, actual experience will be available.

The carbonizing heats are adjusted to burn off the charges in 12 hours. The tubular regenerators offer a 2-ply but thin divide between the waste heat and secondary air, hence ensuring maximum heat transmission and at the same time doubly safeguarding short circuiting. All tubes can be inspected and cleared of flue dust from the front wall, and the cross sections of these machine-made fireclay tubes are sufficiently large to permit repair *in situ*, whence both sides of the 2-ply divide can be pointed; and to give the maximum facilities for attention to the generator, the descension pipe was grouped in front of the dummy chamber.

The keystone of the producer arch is common to the combustion chamber arches, thereby providing additional supports in the most vital spot of the setting. The combustion chamber arches are complete ellipses and are designed large enough for the works' retort setter to pass through easily during the summer periods of overhaul and repair.

By design, instead of the usual solid middle wall of setting on centre of length of the retorts, a silica arch is provided; and as a consequence, the heats remain more stable and the nostrils of both secondary air and producer gas are visible from the sight holes in either front wall of the setting. Thus the whole 22 ft. 6 in. combustion chamber being brought under observation is a feature of much more importance than is generally realized, especially in the proper balancing of heats throughout the length of the retorts.

The stay walls carrying the retorts are composed in each case of the same material as the retorts they support, and are so spaced that 60 p.ct. of the retort surface is exposed to the heating flues. The bench fronts are insulated by insulating blocks built into the firebrick walls. The pier walls between adjacent beds are specially bonded better to cover bed joints and render more tight, thereby preventing infiltration.

The Stoking Machine.

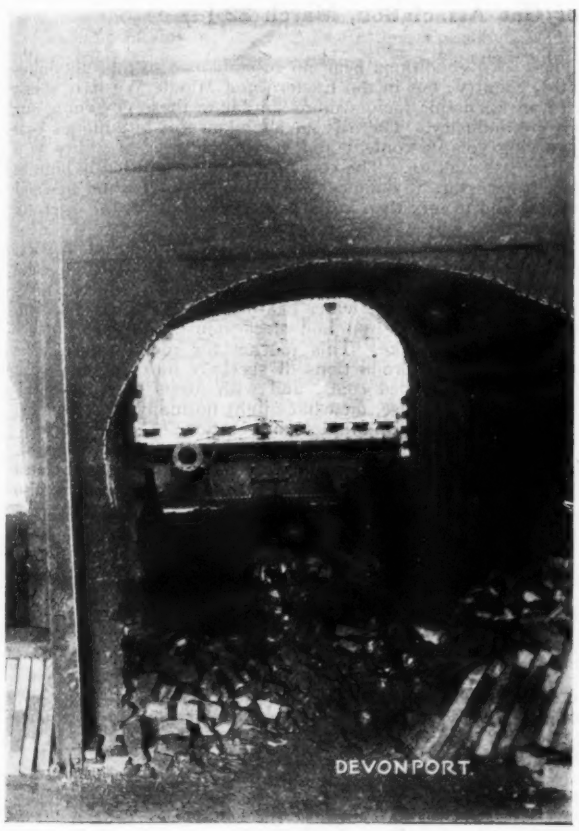
The new stoking machine was manufactured by Messrs. Aldridge & Ranken; and their machines have been working at Devonport for the last 17 years. The maximum weight of the charge by this machine is 17½ cwts., but owing to the high percentage of slacks coming indiscriminately the charges are averaging about 16 cwts. per 12-hour periods. The continuous overhead bunkers have a capacity of 360 tons, which makes it possible to do away with handling of coal to the hoppers on Sundays. The outlet doors are of the "F. A." automatic type, operated by the stoking machine. On the discharging side a

coke-bus, electrically driven, serves the triple purpose of a hot coke furnace-charging chute, a skip filler for the telpher hot coke skips, and a spacious travelling platform to assist the stoker to deal with the top rows of retorts. The existing hot coke telpherage by Messrs. Strachan & Henshaw needed small alteration to be adapted to the new bench.

Satisfactory Working.

The new bench was set to work in June of last year, and has been working at full pressure since October; and throughout the whole period so satisfactorily has it worked that it has been a pleasure to be associated with it.

Figures are fallacious, but the following results are taken from our every-day working. We produce a coal gas of from 525 to 550 B.Th.U., and blend with water gas; each working bed regularly maintains a yield of over 200,000 c.ft. per day, and about 70 therms per ton of coal carbonized. The fuel consumption is very satisfactory, and is less than 10 lbs. per 100 lbs. of coal carbonized. During the winter we have had all 9 beds working, but none of the old benches. The margin reserve is such that, with slightly greater heats, I am seriously considering, another winter, of adopting 10-hour charges instead of 12-hour charges, when I fully anticipate the output per retort will rise some 20 p.ct. to 25 p.ct., while the fuel per ton of coal carbonized will be reduced some 10 p.ct., which economies, combined with putting off capital expenditure for extension, will more than pay for the additional staff.



View showing Elongation.

[This installation of Dempster-Toogood modernized horizontal retorts at Devonport—erected by Messrs. Robert Dempster & Sons, Ltd., of Elland—was the subject of an illustrated article in the "Journal" for July 4 last, in connection with the official opening.]

Discussion.

Mr. T. Carmichael (Portsmouth) said that here once more they saw how local conditions practically settled the type of plant to be adopted by an undertaking—the deciding factor being doubtless the coal which could be most cheaply carbonized. Efficiency had always to be considered in coming to a decision with respect to a new plant; but efficiency did not necessarily go hand in hand with economy. Mr. Blackburn was to be cordially congratulated upon having taken every factor into consideration and having arrived at a very wise decision. The fuel figure was certainly extremely satisfactory, at 10 lbs. per 100 lbs. of coal carbonized. Was this figure dry and ash free? Mr. Blackburn was also to be congratulated upon having increased the capacity by over 100 p.ct. on the same site. How many men were employed on the installation? If the author had the figures, they would be indebted to him if he could give the labour costs per ton of coal carbonized and per therm of gas produced.

Mr. J. S. Thorman (Southall) said he was particularly interested in the system of descension pipes, which was somewhat unusual. At Beckton they had experimented on somewhat similar lines, and had had a good deal of trouble with the take-off valves. There was also difficulty due to expansion. Could the author tell them the amount of liquor circulated per ton of coal carbonized in this system?

Mr. W. H. Warren (Nine Elms) remarked that the paper was of peculiar interest to him, because some years ago he had had opportunities of obtaining experience with Congdon pipes; and although there were difficulties—it was the first installation to be put down in this country—he was very favourably impressed by the possibilities of the system. The chief difficulty was the thickening of the tar in the pits. The author talked about pumping it. In his own case, it was found that picks had to be used after a time. The valves on the ordinary ascension pipe were liable to give trouble from accumulation of pitch; but in the Congdon system there were no branch pipes, which considerably mitigated this. One of the chief advantages of the Congdon pipe, however, was the equalization of the vacuum on the different tiers of retorts. This was quite impossible with the ordinary system of ascension pipes. The equalization was important, because it enabled one to keep the inert gases down to an extraordinarily low figure. There was no difficulty, while maintaining sufficient vacuum to draw away all the gas, in getting that figure down to 8 or 9 p.ct. with the Congdon pipes; and he supposed with the author's arrangement the same would hold good. He would like to ask whether the author made a gas of 525 to 550 B.Th.U. from Durham coal. Getting down to this figure must represent a tremendous infiltration of diluent gases. It might be that the secret was in Mr. Blackburn's assertion that he adjusted his heats to burn-off in twelve hours. There was a question of what a burnt-off charge was. This affected the amount of degradation which took place during the carbonizing of the charge. It might be that the low quality was due to over-carbonizing of the coal. Having such an admiration of the plant, it seemed disappointing that the technical results were not extraordinarily satisfactory, except in regard to fuel consumption. The throughput and therms per ton from Durham coal did not seem extraordinary.

Mr. E. E. Calvert (Fulham) remarked that the author commenced his paper by saying how one looked to the latest methods of carbonizing; and although he had not adopted verticals, for reasons given, he had made many new departures from the usual practice. For this he thought Mr. Blackburn was to be admired, more especially as some of the departures were entirely off the beaten track. He was sure they all wished him success. The descension pipe, he noted, was on one side only—namely, the charging machine side. Would it not have been better practice to have the gas off-take at both ends, or would this have been too expensive? Did Mr. Blackburn work with a vacuum or pressure with the descension pipe, and how many sets were connected to a governor? The figure of less than 10 lbs. per 100 lbs. of coal carbonized for fuel used spoke well for the design of the producer; or was the figure so low on account of the new departures in the setting—namely an open centre wall, and the fact that 60 p.ct. of the retort surface was exposed to the heating flues? This latter was a high figure. The average charge of 17 cwt. was large, and spoke well for the new type of chain in the stoking machine; but on looking at the output of gas, only about 2 therms per c.ft. of retort per day were obtained, and this was a low figure. He saw, however, at the end of the paper that the author suggested adopting ten-hour charges. This practice, providing that a large charge—16 or 17 cwt.—could be carbonized in this period, should greatly improve the results. Allowing for the increase in the quality of the gas which he should obtain, the therms per c.ft. of retort should be increased to about 2·4. The size and shape of retort adopted was, in his opinion, not the best for giving the highest and most economical results. Why did the author go in for such a large section of retort?

Mr. A. H. Andrews (East Greenwich) remarked that in the Congdon system—and he assumed this was similar—the difficulty which he had found was that it was necessary to actuate the valves by means of wrought iron or steel fittings, which in the circumstances had a very short life. If the author's experience was the same as his own, it would not be a very pleasant one. There was one point with regard to the fuel consumption which he could not quite understand. Mr. Blackburn mentioned 10 lbs. per 100 lbs. of coal carbonized, and added that, with a change-over to 10 hour charges, the fuel per ton would be reduced some 10 p.ct., which presumably would lower his fuel consumption to 9 p.ct. He (Mr. Andrews) had certainly never aspired to this; and if the author achieved such a marvellous result, he would merit their congratulations. Personally, his own mind dwelt more upon 12 or 15 p.ct.

Mr. J. W. Whimster (Bath) expressed a desire to learn the labour charges, and said he would be very interested to hear Mr. Blackburn three or four years later reading a paper on the results of the settings.

Mr. W. Hawkyard (Tottenham) asked whether there was any special point in alternating the silica and siliceous beds, and what their behaviour was in subsequent working.

Mr. J. Taylor (Weston-super-Mare) said it appeared to him that difficulty might arise, with the form of design described in the paper, when re-setting a bed in the centre of the bench.

Mr. Blackburn said it was difficult off-hand to answer questions regarding a plant which had been working only a very short time. It was far too early to make any statement as to labour charges involved. There were two men per shift on the charging side and two on the discharging side, one man in the cellar, and a telpher man. There was a shift foreman or ganger, who superintended; and on each shift there was a fireman, who went through the beds once every eight hours. He quite agreed that it would be possible to get more out of the plant than they were doing at present. They

only required, however, a certain amount of gas, and were trying to make the whole bench work together. So they reduced the heat to 1250° or 1280°, and this gave the desired result. Though these results might not be so high as those of people who had not the same margin, he was sure that by increasing their heats, even by no more than 40°, they could carbonize considerably more coal. By using blue water gas, instead of carburetting it to any extent, they were saving a good amount of money. There were two governors—one for four, and one for five beds. The only object in alternating the siliceous and silica settings was that they wanted to gain continuous experience of each material, and of course fewer beds could be working in summer than in winter. There did not so far seem to be any difference. Perhaps on some future occasion he might be able to give members information of a more interesting character.

The President (Mr. W. E. Dean) proposed a hearty vote of thanks to the author.

Mr. R. Robertson (Bristol), seconding, said it seemed to be a thoroughly sound mechanical job. If there was any "snag" in the Congdon system, it was in the stiff emulsion at the foot of the pipe. He had never found that it could not be pumped; but it was a point that had to be taken into account.

Mr. Blackburn remarked that it was his former Chief who was responsible for selecting the plant. It had fallen to his (the speaker's) lot to make it a success.

OBSERVATIONS ON AMERICAN GAS ENGINEERING PRACTICE.

By S. G. Watson, M.Sc. (Leeds), of Messrs. W. C. Holmes & Co., Ltd., London.

[London and Southern District Junior Gas Association, March 22.]

GENERAL SURVEY OF FACTORS INFLUENCING METHODS OF GAS MANUFACTURE.

When due consideration is given to the vastness of the Continent of North America and to its great wealth of such materials as oil, coal, and iron, it will readily be appreciated that conditions must arise that will lead to great differences in the methods of gas manufacture in different localities. We have, firstly, the Southern and South-Western States, where natural gas is very plentiful and is obtainable at such a low initial cost that it can bear the additional charges of distribution at high pressure over long distances—in some cases, of hundreds of miles—and can still be sold at a price sufficiently attractive to obviate the necessity of building gas manufacturing plant in the area in which it is sold.

There is also a great section, embracing a large part of the Pacific Coast and South-Western States, where, just beyond the limits of natural gas, oil is cheap, and coke or low-grade coal is easily obtainable, with the result that manufactured gas is nearly all carburetted water gas—indeed, there are numerous works manufacturing and distributing solely carburetted water gas.

These two conditions bear no resemblance to any obtaining in this country; but in the Eastern and Middle Western States there are economic factors more similar to those governing our own gas industry. There is an abundance of bituminous coal of varying volatile content and varying degrees of utility as a coal for gas-making. The cost of gas oil is sufficiently high to make it necessary to balance the relative costs of water gas and coal gas and to mix the two in proportions best in the interests of economy.

In addition to the above are two very important factors. Firstly, the demand for a strong, hard, slowly combustible coke for domestic purposes, to be used in the popular closed stoves and for central heating, water heating, &c. Secondly, a comparatively prosperous iron and steel industry gives a further market for hard coke. This market for metallurgical coke warrants even the productions of specially hard foundry coke from carefully blended coals, and with ovens operated specifically for that purpose, on what might normally be considered to be primarily a gas manufacturing station.

There are therefore two main demands to be supplied. Firstly, a fairly steady demand for coke, which has dictated that a carbonizing unit must be installed, and which must also be capable of producing cokes with varying grades of hardness, and in order to produce cokes of the required texture, the work

Table I.—*Description of Three Typical Coke Oven Installations.*

Reference No.	1.	2.	3.
Type of oven	Becker regenerative	Willeputte regenerative	Becker regenerative
Number of ovens	100	55	45
Particulars of charge	12½ U.S. tons of blended coal	15 U.S. tons of blended coal	15 U.S. tons blended coal
Method of charging	Top charge and levelling beam	Top charge and levelling beam	Top charge and levelling beam
Temperature in heating flues	2600° Fahr.	2600° Fahr.	2600° Fahr.
Coking time	12–14 hours	15–16 hours	13½ hours for blast furnace and domestic coke 20 hours for foundry coke
Coal carbonized per day	Approximately 2200 U.S. tons	Approximately 1250 U.S. tons	Approximately 1100 U.S. tons
Coke produced per day	Approximately 1650 tons	Approximately 940 tons	Approximately 820 tons
Qualities of coke produced	1. Domestic 2. Blast furnace 3. Water gas coke	1. Domestic 2. Blast furnace 3. Water gas	1. Domestic 2. Blast furnace 3. Foundry coke
Total gas produced by ovens per day	24,000,000 c.ft.	14,000,000 c.ft.	11,500,000 c.ft.
Calorific value of gas produced	570 B.Th.U. (gross)	600 B.Th.U. (gross)	560 B.Th.U. (gross)
Method of heating ovens	By producer gas of C.V. 120 B.Th.U. per c.ft. generated in external producers gasifying small coke—*i.e.*, ⅜ in. size downwards. Preheating both air and gas before combustion	By gas from ovens. Preheating air only	By gas from ovens. Preheating air only
Gas for sale from ovens per day	24,000,000 c.ft.	9,500,000 c.ft.	7,200,000 c.ft.
Water gas produced by same undertaking	50,000,000 c.ft.	None	None
Calorific value of water gas as sold	510 B.Th.U. (gross)	..	..
Calorific value of gas as sold	530 B.Th.U. (gross)	Approximately 570 B.Th.U. (gross)	530 B.Th.U. (gross)
Disposal of gas	Sold to gas company for distribution	Sold to gas company for mixture with C.W.G. and distribution	Reduced to 530 B.Th.U. by benzole extraction and then sold to gas company for distribution
Bye-product plant—			
Primary coolers	Indirect water tube coolers. Vertical tubes	Direct washer coolers	Direct washer coolers
Exhausters	Turbo-blower. 4-stage delivering at 80 in. water guage	Turbo-blower. Single stage. Speed 7500–8000 r.p.m. Delivery pressure 80 in. w.g. Condensing turbine	Connersville blower. 100 c.ft. per rev. Corliss engine drive
Ammonia recovery	Direct system. 2 saturators only, with one working and one as standby	Direct system. 2 saturators, with one working and one as standby	Direct system. With 2 saturators, one working and one as standby, both saturators in the open with no housing
Secondary coolers	Direct washer coolers	Direct washer coolers	Direct washer coolers
Naphthalene extraction	Tower scrubber using gas oil as absorbent	Undertaken by gas company	Section of benzole scrubber used with fresh gas oil as absorbent
H_2S purification	Oxide boxes. Dry lutes	Undertaken by gas company. Oxide boxes	Seabord liquid purification with oxide catch boxes
Meters	Connersville type	Connersville	Connersville

of the oven is usually facilitated by blending coals of different volatile content.

Secondly, there is the fluctuating and seasonal demand for gas; this fluctuating demand necessitating a gas manufacturing unit with flexibility in operation, for which a carburetted water-gas plant is usually installed, either with the carbonizing unit, or at separate stations to be used at peak loads only.

When it is appreciated that the essential characteristics of coke for consumption in America are high density, structural strength, and slow combustibility, compatible with a reasonably low cost of production, it will readily be understood why the larger undertakings have, almost without exception, adopted some form of coke oven for their carbonizing unit.

Furthermore, it must be remembered that these large undertakings are not catering solely for a local demand for domestic coke, but are to supply also the general demand for metallurgical coke and the "export" market for both—that is the market in localities other than their own. They are therefore entering into wide competition, and must necessarily supply and maintain the correct product, which is hard coke.

To quote examples, we find in Eastern Canada coke from the districts around Detroit, Michigan, U.S.A., competing for domestic purposes with coke produced locally, and, conversely, in the Western Central Provinces of Canada, coke produced locally is competing with that produced at La Salle Gas-Works, Montreal. Since the market is both extensive and competitive it is essential to produce a coke of correct physical properties, at a suitably low cost—the former being equally as important as the latter; and to this end coke-ovens have been very widely adopted.

There are, of course, economic conditions that have led to the adoption of either continuous vertical retorts, intermittent vertical retorts, or horizontal retorts as the carbonizing unit; but these appear to be mostly in the case of smaller undertakings, and the unbiassed observer must necessarily conclude that America carbonizes her coal in coke-ovens.

I do not propose to discuss the various types of coke-ovens or their relative merits; but I would like to describe three modern coke-oven installations that I had the opportunity of visiting, and which I think are fairly typical of standard installations.

The summary of the main features of these is given in Table I. (see p. 860).

Cooling and Condensation.

Herein lie many differences from the accepted standards of British and European gas practice. By far the greater part of manufactured gas produced in America is cooled in the so-called "washer-cooler," which appears to have been developed from experience with the "Intensive Washer" which is described later. This apparatus consists of a tower scrubber or series of tower scrubbers with usually the familiar filling of boards on edge, over which is pumped liquor condensed from the gas. The liquor is cooled in external racks of tubes before re-entering the washer-cooler, and after being heated during the cooling of the gas is returned to the coils for further cooling before re-entering the system and so completing its circuit.

There is, of course, a quantity of liquor being continuously bled-off to prevent accumulation. It is interesting to compare the design and performance of this type of cooler with that of the modern type of horizontal water-tube condenser, as used in Europe. Fig. 1 is a flow diagram of the washer-cooler condensing system. From an analysis of figures published and obtained in America, the following data have been drawn up representing a washer-cooler installation, and alternatively a horizontal water-tube condenser, each capable of cooling 5 million c.ft. of gas per day from an inlet temperature of 170° Fahr. (saturated with water vapour) to 90° Fahr., with cooling water at 70° Fahr. The comparison is of interest:

Table II.

Comparison of Operating Data on Washer Cooler and Horizontal Tube Condenser—Cooling 5 million c ft. of Gas per Day.

—	Washer-Cooler.	Horizontal Tube Condenser.
Cooling water per 1000 c.ft. of gas cooled	65 galls.	40 galls.
Cooling water per day, galls.	310,000	190,000
Power for pumping cooling water	4 H.P.	4 H.P.
Cost of pumping cooling water	4s. 6d. per day	4s. 6d. per day
Liquor circulated per 1000 c.ft. of gas	60 galls.	..
Power requirements for circulating liquor	8 H.P.	..
Cost of circulating liquor	9s.	..
Back pressure of apparatus	1 in. W.G.	$\frac{4}{10}$ in. W.G.
Ground space required	400–500 sq. ft.	150–200 sq. ft.

From these figures it will be seen that the washer-cooler does not compare very favourably with more recent developments in indirect water-tube coolers. Both types of apparatus have certain merits as tar extractors, in that they remove a fair proportion of the heavy tar before the gas enters the exhausters, but whereas with the water-tube condenser this tar flows completely out of the system, unless a very careful separation is made in the sump after the washer-cooler, a portion of the tar is inevitably returned through the rack coolers with the liquor, and deposits on the interior of these tubes, reducing their efficiency as heat exchangers, and thereby increasing the amount of cooling water required.

A further criticism of the rack cooler as compared with the closed cooler is that, where surface water or well water is used, it is undoubtedly more desirable to pump water through tubes at a high velocity and with a rapidly rising temperature, as in the water-tube condenser, than to allow the water to trickle slowly over the surface of pipes at a medium temperature and exposed to air and sunlight. The latter conditions are ideal for the deposition of sediment and the growth of slime and organic matter on the pipes, again at the expense of good heat interchange and of cooling water.

It has been claimed that the scouring action of the liquor flowing over the filling of the washer-cooler prevents accumulation of deposits of naphthalene and heavy tar; and indeed, the

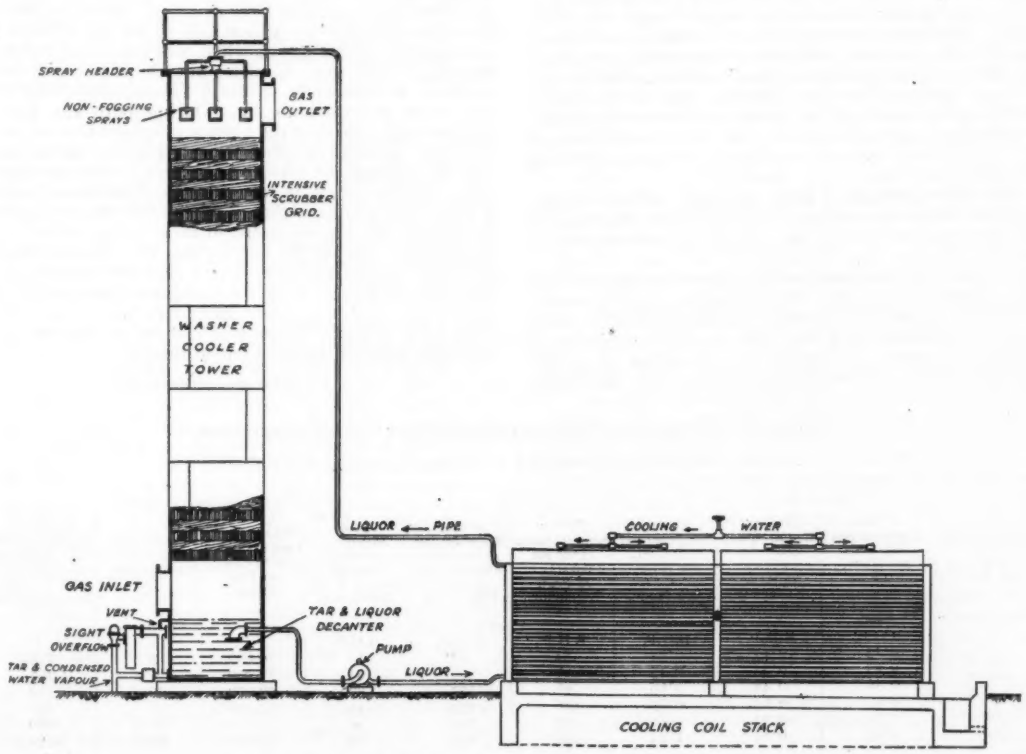


FIG. 1.—DIAGRAM AND FLOW SHEET OF WASHER COOLER.

practice of periodically spraying down the inside of the water-tube condenser has proved efficacious in similar circumstances.

In toto, the balance appears to be in favour of the horizontal water-tube condenser.

EXHAUSTERS.

American exhauster practice is also somewhat divergent from our own. Whereas up to the present time we have developed chiefly the "Beale" type of exhauster as seen in the Bryan-Donkin and Waller machines, the American gas industry uses a considerable number of turbo-blowers and has also developed the impeller type of machine similar in design to the Roots blower, having now reached a very high standard of efficiency with this type of machine. Installations of turbo-blowers show very little difference from similar installations in English coke-ovens, except that they are usually designed for delivery pressures much higher than our own. In England the "impeller" type of machine is more or less novel, and there is no doubt that providing these machines are manufactured with care, they have very interesting possibilities.

The gas is moved by two impellers whose contour is shaped to arcs of circles and involute curves; the two impellers being located inside the casing with very fine clearances between the impellers and the casing, and between the impellers themselves. They are supported by bearings external to the casing and retained in position by one or two sets of gears, one set at each end of the impellers. The gears run continuously in an oil bath, and are readily accessible—being outside the bearings. Machines for delivering gas at pressures above (say) 3 lbs. per sq. in. have a second bearing between the gear housing and the driving unit. It will be seen that internally there are no rubbing or wearing parts, and therefore internal friction is eliminated. With carefully made bearings and well-cut gears, external friction is kept down to a minimum, and consequently a very high mechanical efficiency is obtained.

A high volumetric efficiency is also obtained by making the clearances between the impellers, &c., as small as possible, due consideration being given to the possibility of expansion and the formation of a film of tar or oil on the impeller tips, &c. The combination of both high volumetric and mechanical efficiency must necessarily lead to a high over-all efficiency.

Given in figs. 2 and 3 are two characteristic curves of this type of machine manufactured by the Connersville Blower Co., of Connersville, Indiana. Fig. 2 is characteristic of a works exhauster operating over a wide range of varying speeds, and consequently with a varying throughput, against a steady pressure of 2 lbs. per sq. in. [55 in. W.G.]. Contrary to experience on many types of exhausters, it will be seen that the efficiency curve is very flat; and between the wide limits of 140,000 and 220,000 c.ft. per hour, an increase of almost 60 p.ct. high efficiencies between 70 p.ct. and 75 p.ct. are maintained.

Fig. 3 is characteristic of a high-pressure booster operating at constant speed against varying pressures. This machine is rated to deliver 206,000 c.ft. per hour when working at 385 R.P.M. against a pressure of 5 lbs. per sq. in. It will be seen that over a wide range of pressure, varying from 1 to 10 lbs. per sq. in., this machine has a high efficiency averaging about 75 p.ct., and varying only between the limits of approximately 70 and 80 p.ct. The characteristics of these machines are therefore a high over-all efficiency, maintained over wide variations of delivery pressure and gas throughput, whereas Beale type exhausters have primarily a low efficiency due to the heavy friction load from internal rubbing parts and turbo-exhausters, a medium efficiency applicable to only one set of conditions of throughput and delivery pressure, variations in these, affecting the efficiency very adversely.

Stephen Lacey ["JOURNAL," June 20, 1928, p. 893] quotes the efficiencies of Beale type exhausters and rotary compressors suitable for pressures of 1 to 15 lbs. per sq. in. as between 45 and 60 p.ct.

Table III. shows the comparison in steam consumption and its attendant financial saving when boosting approximately 5 million c.ft. of gas per day against varying pressures, using an exhauster of efficiency 75 p.ct., and one with efficiency 55 p.ct., assuming a steam consumption at the engine of 30 lbs. per B.H.P. hour. The cost of steam is taken at 15s. per 10,000 lbs.

It will be appreciated that economies in steam consumption are of great importance on the gas-works, and tend to adjust the balance so that waste-heat steam may be used exclusively.

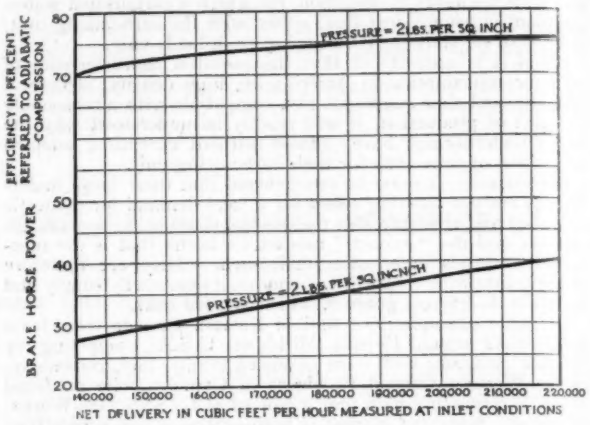


Fig. 2.—Characteristics of a "Connersville" Exhauster operating at a Constant Pressure over a Wide Range of Speed.

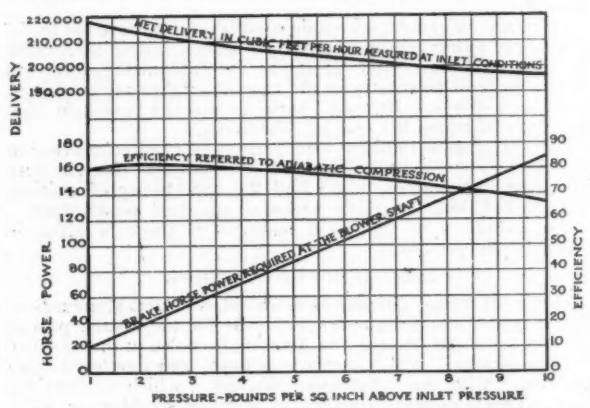


Fig. 3.—Characteristics of a "Connersville" High-Pressure Booster operating at Constant Speed Against Varying Pressure.

At the works of the Rochester Gas Company, New York State, there is an interesting example of this type of machine, used to effect a balance between steam consumption and waste-heat steam available. The machine was built by the Connersville Blower Co., and is used as an air blower on the water gas generator and delivers 30,000 c.ft. of air per minute at a pressure of 50 in. water gauge when running at 225 R.P.M. During the run, it idles over, blowing into the air at only atmospheric pressure, hydraulically operated valves controlling the change over from generator to air. During both run and blow the Corliss engine driving the blower exhausts into an accumulator at a back pressure of about 7 lbs. per sq. in. above atmospheric, and the exhaust steam is used again in the generator for the run. All this steam is raised in the waste-heat boiler attached to the water gas generator; and the low steam requirements of the blower and engine result in there being only a little surplus steam, after driving the pumps, &c., attached to the plant. On the other hand, however, it is estimated that if turbo-blowers had been used they would have required more steam than could have been used for water gas manufacture and there would have been waste. There will shortly be several machines of this type installed in the London district.

(To be continued.)

TABLE III.—*Comparative Power Consumption and Costs of Compression*

[200,000 C.Ft. per Hour by Machines of Efficiency 75 P.Ct. and 55 P.Ct.]

Pressure Rise in Lbs. per Sq. In.	Power Required per 1000 C.Ft. per Hour. 100 P.Ct. Efficiency.	Power Required per 1000 C.Ft. per Hour. 75 P.Ct. Efficiency.	Power Required per 1000 C.Ft. per Hour. 55 P.Ct. Efficiency.	Power Required per Hour for 200,000 C.Ft. 75 P.Ct. Efficiency.	Power Required per Hour for 200,000 C.Ft. 55 P.Ct. Efficiency.	Power Saved by Using Machine with 75 P.Ct. Efficiency.	Saving per Day in Steam at 30 Lbs. per H.P. Hour.	Saving per Day at 15s. per 10,000 Lbs.	Saving per Annum on Steam Costs by Using Exhauster with Efficiency 75 P.Ct. as Compared with 55 P.Ct.
	B.H.P.	B.H.P.	B.H.P.	B.H.P.	B.H.P.	B.H.P.		s.	£
2	0·13	0·17	0·24	34	48	14	10,000	15	274
4	0·25	0·33	0·45	66	90	24	17,000	25·5	455
6	0·36	0·48	0·66	96	132	36	26,000	39	710
8	0·47	0·63	0·85	126	170	44	32,000	48	870
10	0·55	0·73	1·00	146	200	54	39,000	58·5	1060
12	0·63	0·84	1·15	168	230	62	45,000	67·5	1230

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Midland Junior Gas Association was held on Thursday, March 14, at the Council House, Birmingham; Mr. W. McNAUGHTON (Wolverhampton) presiding, in the unavoidable absence of the President, Mr. F. Caudwell.

A SHORT ACCOUNT OF AN EDUCATION SCHEME FOR BOYS AND FITTERS' YOUTHS.

By FRANK A. JENKINS, A.C.I.S., of Leamington Spa.

[Abstract of paper.]

I have written this short paper in the hope that it may be of use in showing that gas undertakings other than the larger ones can do something to provide that training for their fitters which is now essential if efficient service to the public is to be provided.

It will be freely admitted, I think, that a fitter's training will be very far from sufficient if it does not include something more than the information he can acquire in the course of his work. If he is properly to understand the working of the very large variety of gas appliances now in use, it is necessary that he should have at least some knowledge of the reasons why an appliance is designed in the way it is, and why adjustments to it have a certain effect. In other words, he wants a certain amount of scientific knowledge.

Apart from this, a youth will much sooner obtain a knowledge of his craft on the practical side if it is possible for him to obtain a progressive course of instruction than if he simply picks up what he can from the fitter with whom he happens to be working.

THE VALUE OF EXAMINATIONS.

Another advantage of an organized technical course is that it makes it possible for a fitter to obtain a definite testimonial to his ability in the form of a certificate of the City and Guilds of London Institute and the Institution of Gas Engineers. Such a certificate should be a most valuable asset to a man seeking to progress, and increasingly so as the excellence of these examinations becomes more generally recognized. Examination may not be the ideal way of ascertaining the capability of a man as a gasfitter, and I see that the examination system is again being strenuously attacked; but, as has been pointed out, not even its severest opponents have succeeded in suggesting a substitute.

When it is considered that the City and Guilds examination, in the higher grades, comprises a written paper, a practical test, and a *viva voce* examination, it seems that it would be impossible to provide a more complete indication of a man's value short of actually employing him for an extended period. That the examinations do really form a reliable guide as to whether a man or youth is likely to be satisfactory in his work has been borne out in our own experience.

The larger works, of course, have had in many cases very complete schemes operating for a considerable time; but where a comparatively small number of men are employed, other difficulties are introduced, though it has been found at Leamington that these are not so great as might at first be considered.

CLASSES OPEN TO ALL.

I should at once make it clear that the classes at Leamington are not part of the Company's organization. They have been made possible entirely by the sympathetic attitude of our technical school authorities, and are included in the ordinary syllabus of the school. They are therefore open to anyone not connected with the gas undertaking, but though there have been a few such students, at present those attending are all employees of our own or of our neighbouring gas undertaking.

In our case the development of gasfitting classes has been quite gradual, and commenced by encouraging a few of the keener gasfitters' assistants to attend the most suitable classes then available. I should mention at this point that we have no apprentices, but boys are taken into employment on the understanding that providing their conduct and progress prove satisfactory, they will be taught the general routine of gasfitting practice.

THE COURSE OF STUDY.

After a year or so, a series of classes more specially suited to gasfitting students was arranged, making it possible to provide a definite course of study. The first year classes are not special to the gasfitting students, but are those included in what is called the Junior Technical Course, and comprise English, arithmetic, practical drawing, and elementary science, amounting to six hours per week, and requiring attendance on three evenings. The second year classes are the first in which practical work is done, and include one evening per week of this and one evening devoted partly to lecture and partly to sketching and arithmetical problems bearing on the subject of gas supply. Third year classes are approximately the same, but with more advanced work.

We follow the syllabus of the City and Guilds of London Institute and the Institution of Gas Engineers, taking their Grade I. for our second and third years and their Grade II. and Final for the fourth and fifth years. As the above-mentioned syllabus is easily obtainable by anyone interested I will not give any details of the work done, but I should say that a considerable proportion of the time is given to the explanation of scientific principles involved. If I mention such instances as water circulation, burner adjustment, the leak indicator, ventilation, illumination intensity, the effect of height on pressures, and the measurement of heat, the importance of this side of the subject to a proper understanding will be at once appreciated. In dealing with such cases, the principles concerned are illustrated by other examples outside the range of gas supply, and the development of wider interests is encouraged.

Drawing as distinct from sketching is not now required in the examinations, but all students are taught the principles of projection and the use of scales, &c. The ability to understand a plan or working drawing is valuable.

THE COURSE CRITICIZED.

Our course has been criticized by reason of its comprising only two evenings per week other than in the first year; but it is surely preferable to have a regular attendance on two evenings than an irregular one on three. It must be remembered that during the winter months when the classes are held, the older students are often required for a certain amount of overtime work, and in addition to the classes, a series of lectures by the technical experts of gas appliance makers are held at the Company's showrooms. As against those who would prefer a three evenings a week course, many people interested in technical education advise that classes should be held during the day and the time devoted to them paid for by the employer. Personally, I consider that what is obtained for nothing is valued at a similar figure, and I do not think that a gasfitter's assistant's or junior fitter's work is so physically arduous as to make a healthy youth unable to take proper advantage of an evening class, while mentally he should be nearly as fresh as when his day commenced. Following the idea that what costs something is more fully appreciated, each student is required to pay his own class fee at the commencement of the session, but this is refunded by the Company if he makes a minimum of 75 p.ct. attendances and satisfactory progress. The excellent record of attendances obtained is probably due to some extent to this.

REWARDS FOR SUCCESSFUL STUDENTS.

When a boy is first employed he is told that attendance at the classes will be required, and encouragement to students is given by basing a proportion of wages increases on the results obtained in class work and examinations. Prizes are awarded by the Directors to the most successful students, while other prizes are given by members of the teaching staff. At Leamington it has been found that making attendance at classes a condition of employment has automatically eliminated boys who either through laziness or inability looked on their work as something to be endured for the sake of their wages; and the greater keenness and interest of the younger boys has been very noticeable.

When a student finally leaves the classes he should be not only a better gasfitter with a more complete understanding of his work and therefore a greater interest in it, but the application of the knowledge he has obtained apart from his work should give him a wider outlook and further interests, and make him a better and happier man.

REDUCTION OF MAINTENANCE COSTS OF MAINS AND SERVICES.

By F. A. C. PYKETT, Distribution Superintendent, Coventry.

The fundamental principle underlying the reduction of maintenance costs, especially in the distribution department, and by that I refer to the work carried out from the station governor to the consumer's meter, is to make sure that only the best workmanship and materials are used in the first instance—that of laying the pipes. This work has been out of sight, and out of mind too perhaps, in times past. Unsuitable materials and poor workmanship increase the cost of repairs and renewals.

LOW-PRESSURE DISTRIBUTION.

Cast iron holds the field for low-pressure distribution. It has stood the test of time, and, laid in suitable soil, appears to last indefinitely. We are considering the claims of spun pipes against our experience of vertical cast pipes, and after a short experience of spun pipes I am satisfied that these are composed of a homogeneous metal of a density considerably in excess of the ordinary vertical cast pipes; and in view of the fact that

mains are now generally laid in the footpaths, I am of the opinion they will find favour with distribution men and gas engineers in many instances.

This statement of indefinite life can in no way be applied to steel pipes. This class of pipe has to be carefully protected against external corrosion. It is most important to see that none of the protective covering is disturbed, either before the pipes are laid or afterwards. Serious trouble may soon develop if moisture gets between the main and the covering. Careless handling of the covering is most likely to occur when contractors and others are excavating alongside, or near, the steel main. Another drawback to the general use of steel main is its high conductivity of electrical current. In towns where tramways are in operation, leakage of current from the system may cause continual trouble of a serious kind. There does not appear to be any great saving in the use of steel pipes as compared with cast-iron for low-pressure distribution. Any saving in the initial cost by the reduction of the number of joints or on trench work is counterbalanced by the additional cost of specials and special connections for service work.

High-Pressure Distribution.

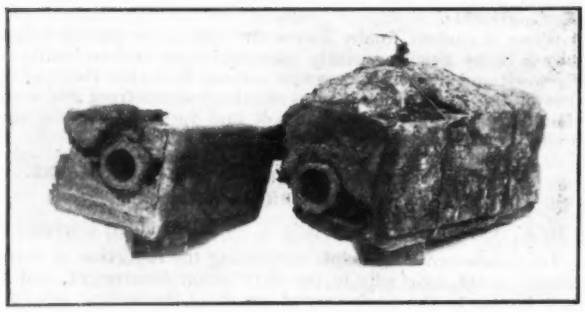
For high-pressure distribution we are limited to the use of steel pipe. This is the only suitable material which will withstand high pressures with any degree of safety. There are various methods of jointing steel pipe which will remain gas tight at very high pressures after many years in use. Personally, my experience leads me to favour the use of the butt welded type as being the most efficient when properly made.

For the jointing of cast-iron pipes the open socket and spigot made with yarn and hot run lead appears to be universally used. There are other types of joints in general use, such as yarn and lead wool, yarn and lead wool with the insertion of a rubber ring in the centre of the lead wool, and a combination of yarn, lead wool, and hot run lead. This combination makes a stronger and tighter joint than one made of yarn and hot run lead only. At present on all pipes of 8 in. and larger we are using this combination of lead wool and hot run lead. The turned and bored joint when correctly made is a perfect joint, as far as being gas-tight is concerned. It is, however, unreliable if the ground is subject to subsidence or great changes of temperature. I have used a large number of turned and bored joints in suitable districts, and having found them quite satisfactory.

The principal object in the laying of any main underground is to make sure that the pipes are laid on a solid foundation. It is a great mistake to undercut the trench bottom, and then to have to fill in or pack the pipes to the required level.

An Analysis of Repair Costs.

Wrought-iron pipe appears to be principally used for gas services, and in many undertakings a pipe of steam strength is laid in its ordinary state. In order to reduce the maintenance costs of gas services to the minimum, there is little doubt that the pipe should be protected against corrosion by some form of external covering. This practice is by no means new, and it would be of great interest if credit could be given to the pioneer. I am informed that the method was introduced as early as the year 1860 by the Engineer of the Perth Gas Department, Mr. Whimster, the grandfather of the present Engineer at Bath.



Service Pipes Well-Preserved after 40 Years.

In Coventry the practice was commenced about 1870. The present method in use is to lay the service pipe in square wood troughing, and completely to encircle the pipe with a mixture of wood dust, tar, and pitch, the mixture being previously prepared and thoroughly mixed by warming. Services examined after many years in use are found to be in an excellent state of preservation. A photograph of a service is submitted for your inspection. The following analysis of the cost and number of renewals carried out in Coventry for the year 1927-28 will give some idea of the very small percentage of renewals necessary through actual wear. The total number of gas services in use is 42,000.

Repairs to Mains.

	£	£		£
33 escapes	175			
7 repairs	36			
62 miscellaneous	71			
		282	Repairs necessary through wear	282
Districting	250			
Enlargements	100			
Private work to charge to consumers	178			
		528		
		£810		

Repairs to Services.

	£	£		£
93 escapes	101			
113 relaid	331			
86 miscellaneous	103			
		535	Repairs necessary through wear	535
68 enlarged	187			
169 altered	236			
95 cut off	99			
93 reconnected to enlarged mains	143			
		665		
	£1200		£810 1200	
			£2010	£817

I have no experience of the life of steel tube for service work. The Halifax Gas Department has laid several thousand feet of "Armco" tube, but it is too early to state definitely the life of this material when laid underground.

Lead appears to wear well underground, and is in general use in many towns for the distribution of water. It has been used for gas services, and I have seen these in an excellent state after years of use. I think the chief reason why this material is not in general use for gas services is because it is not rigid and has a tendency to sag and allow moisture to collect in the dips instead of draining back to the main. While it would be ridiculous to say that if gas were dried pipes could be laid irrespective of "falls," there would be a considerable reduction in distribution expenses by the saving in attention to syphons, complaints, and probably a reduction in the maintenance costs of meters.

Much time and money can be saved by proper office organization and Ordnance survey records. The plotting of mains is one of the most important parts of distribution organization. If this work is carried out on Ordnance survey sheets of 500-scale there would be no necessity for any further medium of information such as record books or index cards, &c. In Coventry the whole of the mains, services, and meter positions are plotted on 500-scale sheets. These are enlarged from the 2500-scale, and new estate development is usually obtainable from the architects and surveyors carrying out the work. In every instance when it is necessary to excavate for main or service renewals the information respecting the position of such main or service is given on the work card. This eliminates waste of time in seeking underground pipes. It is a general practice when carrying out new service work that all supplies are individual and taken in a direct line to the property. Lamp services are taken direct, and never from consumers' supplies. A schedule of positions for the relative public utility undertakings' various supplies is strictly adhered to. The foreman and workmen become acquainted with these details which may appear minor in a sense, but all help to save waste of time on the district.

Unaccounted-for Gas.

No paper on the present subject would be complete without a few words upon unaccounted-for gas. Unaccounted-for gas may be classified under two headings: (1) That which is actually lost, and (2) that which is seemingly lost.

The amount which is actually lost is a comparatively small percentage of the whole. The inaccuracies in the registration of consumers' meters and the computations of lamps for public lighting, together with the differences in temperature at the points of registration, appear to make the total unaccounted-for gas considerably greater than the amount which is actually lost.

The Chairman, at the conclusion of the papers, congratulated the authors. Referring to Mr. Jenkins' paper, he agreed that the education of gasfitters was a most important matter, and commented upon the great encouragement which the Leamington Gas Company gave to the youths in their employ. He had been very interested also in Mr. Pykett's paper, which contained much valuable information. In Wolverhampton they had found that lead wool joints would not stand up to the required pressure, and they had reverted to the yarn, lead wool, and molten lead joint.

Mr. W. L. S. Spinks (Birmingham), in proposing a vote of thanks, said he had visited Leamington in connection with the City and Guilds Examinations last year, and the Company were to be congratulated upon their organization. In small undertakings the success of the classes usually depended upon one man taking a keen interest in the work. He testified to the interest of the Technical School Authorities throughout the country, and their readiness to give

all the assistance they could. He noticed that the first year course was non-vocational; this was not only carrying out the accepted rules of the City and Guilds, but in his opinion was distinctly on the right lines. He agreed that two nights per week were as much as one could ask a manual worker to give; three nights per week were likely to kill the interest of the students in the first twelve months. It was a most valuable paper to small undertakings.

Referring to Mr. Pykett's paper, he said he thought most gas undertakings had only recently begun to realize that the mains and services were part of the undertaking which also required maintaining; hitherto it had certainly been a case of "out of sight out of mind."

Mr. W. E. CADWALLADER (Birmingham) seconded the vote of thanks. As an old teacher of gasfitters' classes, he had thoroughly enjoyed Mr. Jenkins' paper. At Leamington they were evidently carrying out their classes on very sound lines. The size of the classes was not too great, which was a decided advantage. In Birmingham the classes were apt to be somewhat unwieldy. Birmingham provided classes for gasfitters' assistants free of charge, and also offered prizes, but he did not think, generally speaking, the students appreciated them as much as if they had to pay their own expenses. When a fitter became 21 years of age he had to pay a class fee, but if he made 75 p.ct. of attendances, his money was refunded. Regular attendance at the classes was absolutely necessary, and in Birmingham they made it compulsory for the juniors to attend.

Referring to Mr. Pykett's paper, he was very interested in the life of service pipes, which spoke volumes for the efficiency of the surrounding medium. He noticed that Coventry used plain wood troughs, whereas in Birmingham they used tarred-wood troughing made of much thinner material. He emphasized the importance of planning the positions of all mains and services.

Mr. A. KENDRICK (Birmingham), commenting upon Mr. Pykett's paper, said he thought the thickness of timber used in Coventry for protecting their services might be considerably reduced, and thus materially reduce the cost. He agreed with the author as to the superiority of wrought-iron pipes for service work. In Birmingham they used two gauges stronger than steam strength to get additional life out of the services.

Mr. S. W. SIMMONS (Dudley), commenting upon Mr. Jenkins' paper, said that wherever possible they engaged secondary school boys of 15 years of age, who were on probation until they reached the age of 16. They were then apprenticed for five years, during which time they attended Technical School for two half-days per week, in addition to two evenings per week for gasfitting work—one evening theory and the other practical. He did not agree that what was not paid for was not appreciated. Where a boy definitely wished to get on he would appreciate what was done for him, and a lazy boy would not try in any case.

A vote of thanks to both Mr. Jenkins and Mr. Pykett was then carried with acclamation, and both gentlemen suitably replied.

SCOTTISH JUNIOR GAS ASSOCIATION (EASTERN DISTRICT).

Visit to Messrs. Peebles' Tay Works.

A Meeting of the Association was held on Saturday, March 9, when about 60 members met at the Tay Works of Messrs. Peebles & Co., Ltd., in West Bowling Green Street, Bonnington, Edinburgh.

The visitors were received and welcomed by Lt.-Col. W. CARMICHAEL PEEBLES, D.S.O., D.L., the Managing Director.

[A short résumé of the firm's activities will be found in the report of the Western District's visit to these works in the "JOURNAL" for Feb. 6, 1929, p. 356.]

The party were then divided into groups, and each travelled over the entire works conducted by a member of the staff. Completed models and the components of the firm's meters, governors, &c., of all types and sizes were shown in the making, assembling, under test, and in operation.

SELF-LOADING GOVERNORS.

Special interest was evinced in the many more recent inventions patented by Messrs. Peebles & Co. to meet the ever changing conditions in the industry, and to provide better and more ideal control over the industry's service to consumers. Notable among these were the automatic self-loading governors, designed to give more equal pressure over districts where widely varying demands for gas would lead to considerable variations in pressure. These governors, being set to throw a minimum pressure at minimum demand and a maximum pressure at full load, automatically vary the pressure proportionately as the demand varies.

There are two types, one depending on the variable movement of a rolling weight which is caused to move in a definite direction through a curve fixed on the automatic arm and acting in relation to the stroke of the valve, and thus adding to, or removing weights from, the governor bell according to the district requirements. In the other case the governor may be loaded by the inlet gas pressure through a small auxiliary governor. Instead of an automatic arm (carrying the curve and rolling weights) attached to the governor valve rod, there is a mercurial cup into which a dipping rod attached to the valve spindle of the small auxiliary governor is carried. As the main governor bell, and consequently the mercurial cup, rise or fall, so will the dipping rod gain or lose its buoyancy, and thus reduce or increase the pressure thrown by the small auxiliary governor. The outlet pressure from the latter is conducted to the crown of the main governor bell, and serves to unload or to load the main governor according to the demand.

A further feature embodied in these governors is the provision of shutters or baffles fitted to the valves. These may be opened or closed during the periods of large or small loads.

A "B.V.R." GOVERNOR EXPERIMENT.

The "B.V.R." governor, which is described in the report referred to above, also attracted considerable attention, and a demonstration of the extreme sensitivity of this apparatus created great interest.

A piece of flexible rubber tubing was attached to what is known as the impulse pipe connection of the diaphragm chamber. Ordinarily a pipe is connected to this from the main upon which the butterfly valve is fitted and which it has to control. By blowing gently across the end of the flexible tubing the pressure on one side of the diaphragm was increased, and by this means the high-pressure air piston, accommodated in the governor adjacent to the main and connected to the main by two small diameter tubes to the diaphragm chamber, was moved slightly; and, the piston being connected to the butterfly valve inside the main, the opening was immediately altered.

A NEW CLOCK LOADING DEVICE.

Of equally outstanding interest was the new clock loading or unloading device in which use is made of the mercury cup dipping rod and the small auxiliary governor already mentioned. The vertical movement of the rod is secured by suitable cams and levers attached to the clockwork mechanism; and as the dipping rod gains or loses its buoyancy in the mercury, so the weight of the lever attached to the auxiliary governor valve spindle is reduced or increased accordingly, this in turn unloading or loading the main governor.

The clockwork mechanism, while not actually manufactured by Messrs. Peebles, is made up to their specification, and may be provided with any form of cam. The latter, being interchangeable, provides for altered conditions over certain periods of the year. The clock may be of the forty-five day type and require only periodical inspection, such as for winding, &c., the varied Sunday conditions being met by the employment of a special cam which comes into operation on that day only. The change over from week day to Sunday takes place early on Sunday morning, and from Sunday to week days early on Monday morning. The times of sunrise and sunset may be adjusted for by a special trigger to the cams.

Tinplate dry meters, ordinary and coin freed, of the lights, standard, and high-capacity varieties, also a new lights type in small case, were shown finished and in process of building. In one or two of these the new stuffing box containing fine cork, recently patented by the firm, had been fitted, and it was said that following the exhaustive tests and observations which these successfully withstood at the works, arrangements had now been made with gas engineers in many parts of the United Kingdom to accept samples to try them out. If favourable reports were received, this product would be marketed.

All departments of the works having been examined, the visitors were then conducted by bus to Ferguson & Forresters' Restaurant in Princes Street, where they were entertained at tea by the firm; Lt.Col. Peebles occupying the chair.

Mr. R. J. GAVIN, the President, expressed the gratitude of the Association for the opportunity of inspecting the Tay Works, where the painstaking efforts of Messrs. Peebles to meet the needs of the gas industry in supplying consumers with unvarying pressures must have been obvious to the visitors. They had seen some most ingenious arrangements to that end.

A hearty vote of thanks for the provision of such an attractive afternoon was then extended.

Col. PEEBLES thanked Mr. Gavin and the members for the kind expressions, and said it was a pleasure to be able to show the visitors his firm's endeavours to give satisfactory service. Appliances which one might think were ideal to-day would become old to-morrow, and so it was necessary to turn new thoughts to their products from time to time. In different towns there were different conditions, and the firm had to provide governors of all sizes to deal with pressures of a few inches water gauge up to 50 lbs. In consequence, it was essential that they should have at their finger tips a mass of detail so that easy and rapid reference could expedite supply to meet any requirements. It was, indeed, no uncommon ex-

perience to supply a small part for an appliance installed twenty years ago.

The visitors, he continued, would be able now to form their own conclusions on the suitability of Messrs. Peebles' products. The tests they had seen carried out (and which frequently were applied over many years) in order to ensure that the article be absolutely accurate would help in that matter.

Mr. GAVIN then informed the meeting that a communication had been received by the Council intimating that the Institution of Gas Engineers had decided to award the Institution's Medal in Bronze for the best paper read by a member to the Junior Association during each year. He hoped that a determined effort would be made by the Eastern District members to secure this medal.

He then called upon Mr. Warden to read his paper.

MAINTENANCE.

By D. WARDEN, of Dundee.

[EXTRACT.]

The problem of maintenance should receive serious attention. For the past three years the Dundee Gas Department have had in operation a scheme, and with all its imperfections, and with the difficulties with which new schemes of any kind are confronted, this particular one seems to have come to stay. In Dundee there are 56,206 gas consumers, using the following appliances:

Cookers	25,946
Hotplates	1,657
Grillers	4,523
Boiling rings	13,518
Total of cooking appliances	45,644
Gas fires	16,975
Radiators	1,786
Geysers	88
Total of heating appliances	18,849

Meters.

Ordinary	26,275
Automatic meters	27,449
Stair contract lighting	2,482
Total consumers	56,206

HIRE PURCHASE AND CASH SALES.

A new development has been introduced, in the form of offering gas consumers the opportunity of purchasing a cooker, fire, geyser, or radiator on the hire purchase system. By this plan a consumer may find it convenient to buy a cooker or fire of a better grade than the "free on loan" appliance. These appliances can also be bought for cash. The following are the figures for hire purchase and cash sales for the year ended December, 1928.

Regarding the carcassing of housing schemes, we have had in Dundee a staff of gasfitters employed on this work since 1919.

—	Hire Purchase.	Cash Sales.
Cookers	160	111
Boilers	..	65
Fires	20	209
Radiators	9	80
Geysers	7	25
Baking plates	..	13
Hotplates	..	5
Grillers	..	15
Rings	..	28
Totals	196	551

Sixteen men now constitute the permanent maintenance staff. In many cases where in old properties the size of the service inlet was inadequate for the supply of gas to a fire or cooker, the report of the maintenance inspector has given valuable data, to enable this all too common fault to be remedied. Consumers' complaints and requirements are also very carefully noted and just as carefully attended to. The maintenance of radiators is not included as part of the maintenance inspectors' duties, those appliances being attended to by a staff of specially trained men who are selected from the gasfitting staff. It is perhaps important in a large gas undertaking (or a small one for that matter) to have gas fire and stove inspectors of a highly trained type. In the repair side of maintenance work it is of some importance to have workmen with a knowledge of the metals and solders they handle.

Discussion.

Mr. GAVIN, in opening the discussion, pointed out that one of the difficulties in regard to the periodical inspection of appliances was that the maintenance operative made his call during the day, and while he might adjust the appliances to suit the pressure applying at that particular time it might not suit another period when the load was changed. He asked what type of service was used at Dundee, and if any tests were carried out following delivery.

Mr. H. DUFF (Edinburgh) asked how many calls were made to adjust lighting burners during the six winter months. In his opinion there should be at least two calls each month, especially in districts where burners were to be found fitted above the fireplaces in which coal fires burned.

Mr. C. D. BLACKHALL (Edinburgh) asked how many geysers were overhauled during the year, and if any effort had been made to standardize cookers and other appliances.

Mr. J. FORD (Inverness) asked what figure per 1000 c.ft. of gas sold the carrying out of maintenance work meant, and if there had been experienced any opposition from the local plumbers.

Mr. WARDEN, replying, first referred to the maintenance of lighting burners. He said that two calls were made in the winter months as well as in the summer time. He agreed that it might, in certain cases, be desirable to call more frequently. No charge was made except where new materials were necessary. In connection with geysers, these were inspected by the maintenance men at the usual periods. There were, however, special men employed for the relining of geysers, and that service was carried out free provided it was the result of ordinary wear and tear. A stock of geysers for temporary replacement of those removed for relining was kept so that the consumer suffered no inconvenience, but rather the reverse. He preferred not to give any figure as indicating the cost. These he had himself not tabulated sufficiently to enable reliable information to be given. There had been opposition from the local plumbers, he continued, but it had been pointed out to them that most of the appliances were the property of the gas undertaking, and therefore did not come under the plumber's jurisdiction. In regard to service pipes, use was made of the steel tube coated and wrapped. Ordinarily no tests were made on delivery.

Mr. ALICK C. REA (Edinburgh) then followed with a short paper on "Some Gas-Works Gauges, Recorders, and Meters."

SOME GAS-WORKS GAUGES, RECORDERS, AND METERS.

By ALICK C. REA, Edinburgh Corporation Gas Department.

All gas-works, irrespective of size or location, use gauges, recorders, and meters in some capacity or other, and in recent times the modern undertaking is adding yearly to the number of these instruments. It is now found necessary for efficient working to have a concise record or spot reading in many operations, and the recorder, meter, or gauge, is the medium used to give the required figures.

I do not intend, in this short paper, to give details of any of the instruments in use in the modern gas-works, for this can be had from the makers' catalogues, text books, or from a very useful book by Levy on "Gas-Works Recorders," in which many of the latest instruments are fully described, with accompanying sketches and photographs. I wish rather to mention a few points which may help in obtaining the best and most efficient service and results from the instruments which you may have fitted on your works, and probably suggest one or two instruments which make more accurate working.

INACCURATE INSTRUMENTS.

It is not uncommon to find that when a gauge, meter, or recorder is installed, it is accepted as 100 p.ct. accurate. This may be; but after that, though the instrument may have varied, the figure indicated usually gets the benefit of the doubt, and is accepted as showing the true state of affairs. In a works employing a number of instruments, it would not be uncommon to find a fair percentage of these inaccurate. Inaccuracies will occur in most instruments with time and use—a fact that must not be lost sight of—and to prevent ensuing errors, sufficient skilled attention must be given.

It is essential for good working that the man responsible for the instruments understands their functioning, is able to spot a possible error, and also check the instrument for accuracy, or have it checked by the makers, if and when necessary.

COMMON GAUGE ERRORS.

Gauge errors may be found to be one of the following:

(*a*) Constant errors; (*b*) errors which change more or less gradually over the whole scale; (*c*) discrepancies between the readings obtained when the pointer is rising and falling over the scale; (*d*) erratic errors, which do not seem to follow any law of change. Errors in the case of the ordinary water column gauge and **U** tube may be due to (1) partial or complete blockage of one or both pressure tubes; (2) leakages in pressure pipe; (3) the zero reading of the instrument not corresponding with the scale zero; or (4) wrong graduation of the scale to suit the liquid employed. It is surprising how easily an ordinary gas pressure gauge, which one anticipates to be reading about a certain figure, may, through some defect, become permanently stuck at its normal reading and remain so unnoticed.

WATER TINTING.

All **U** gauges and pressure gauges, both indicating and recording, should be cleaned out periodically and checked

against a standard. In a recording gauge the pen should be let down to check the zero when each chart is put on; otherwise, if zero be recorded at the wrong position of the chart, an erroneous figure will give misleading results and perhaps cause adjustments to be made in the working of a plant, which will be detrimental to its efficient running. One very useful aid in reading an ordinary **U** tube or any water column gauge is to add to the water some alkaline solution of phenolphthalein, thus giving a red colour to the water, which facilitates the reading.

An improvement on this is to dissolve a little xylene cynol in water, to the required coloration, and thus give a blue tint. This solution has the advantage over the former in that it is not affected by acid atmospheres; both are an improvement on the ordinary clear water and give better appearance to the gauges. Other compounds may be used equally effectively.

If the pressure to be measured is small, an extended scale can be produced by having the **U** gauge inclined. The increase in the scale is proportionate to the sine of the angle of inclination, and so a scale can be constructed to suit the angle adopted, thus making small differences in pressure more easily read. When used on the angle the manometer should be firmly clamped to obviate any inadvertent alteration from the proper angle, which would upset the scale. If a small level is incorporated in the block to which the manometer is fixed, it can be seen at a glance if the angle is correct. Conversely, if the pressure requiring to be measured is relatively high and would give a water column of an impractical length, a liquid of higher specific gravity than water should be used. Mercury is perhaps the most common liquid for such a circumstance and is unaffected by ordinary atmospheric conditions. The only difference to be noticed in reading these two liquids in a **U** tube is that with water or a solution in water, the lower part of the meniscus curve should be read, and with mercury, the higher part.

Freezing of Water in Gauges.

If water be used, it is not uncommon to find that with some exposed gauges it becomes frozen during severe weather. A liquid of low freezing point should then be adopted, such as alcohol (suitably coloured), salt in water, or glycerine dissolved in water.

Some time ago we experimented at Granton with glycerine solutions. Pure glycerine has a slightly greater effect in lowering the freezing point than crude, but not in proportion to cost. A 25 p.ct. admixture of glycerine with town's water lowered the freezing point to about 16° Fahr., and a 50 p.ct. solution to 5° Fahr., after which there was no appreciable change observed.

The liquor found in gasholders and governors has a freezing point below 32° Fahr. due to substances dissolved out of the gas, the freezing point being about 20° Fahr. An addition of 10 p.ct. glycerine to these liquors will give a freezing point of about 10° Fahr., and other quantities in proportion.

These anti-freezing solutions may be used in lutes, governors, or gauges. The differences in specific gravity should be allowed for on the scale of manometers, when using such liquids, but this can be overcome by adding equal quantities of glycerine and alcohol, which has a Sp. Gr. approximately equal to that of water. The glycerine, alcohol, or water should be mixed to the required volume in a separate tank before being used.

If a water gauge be placed in a position where the surrounding temperature is relatively high—such as near a boiler, a chimney, or part of the retort bench—there is a tendency for evaporation to take place, causing loss of water, with resultant alteration of zero. To overcome this loss, a light oil may be used effectively, thus ensuring a constant zero. The zero in an ordinary two limb gauge is not, of course, very important, as it is the difference in level which matters; but in a single limb gauge the reading is actually altered.

The Single Limb Gauge.

The single limb gauge is now coming into favour, and it has many points to commend it. A direct full scale reading is given; the water is always clean in the reading limb; and it can be arranged either for pressure or vacuum, or both. An adjustable zero can also be had to compensate for evaporation. Most of my previous remarks can also be applied to these gauges.

Attention to Clockwork Mechanisms.

In all instruments where a clockwork mechanism is used to drive a chart, &c., these clocks occasionally require attention, and should be regulated and adjusted periodically. This is important, because if at any time it is necessary to refer to a chart record of (say) the pull on the retorts, the holder pressure, the H_2S record, or some other similar record, it is essential that the time portion of the recording be accurate; otherwise, assumptions as to some particular happening may be shown to take place on the chart at other than the actual time of occurrence.

Another error, though small, which might be mentioned is that due to the radius of the pen arm not coinciding with the radius used in printing the lines on the chart. This is usually due to the pen arm becoming bent and thus shortening the effective radius and slightly upsetting the time of recording.

Charts themselves should always be properly marked with dates, instrument, or place in which records are taken, and initial and final readings if on a meter. Pens should bear on the chart so as to give a good line, but not so hard as to cause any undue friction.

The Station Meter.

The metering of gas at the works is normally done by the wet drum meter.

These meters are periodically checked against a small standard meter at probably only a small fraction of normal throughput. The large meter is then corrected to read within a small limited error, but at full load it will almost certainly be reading differently, due to the increased speed of rotation of the drum, causing water movements; the higher differential pressure over the drum causing the gas to be measured at a higher pressure.

A difference of 5° Fahr., or 4 in. water gauge, is approximately equal to 1 p.ct. in volume, so that errors are liable to come in; but, knowing the normal pressure of the gas as measured in the station meter, by a simple calculation showing the differences in volume of gas measured at check and normal throughputs, the required allowance can be made in resetting the meter so that it registers more nearly accurately under working conditions. The probable error due to increase in pressure would be about ½ p.ct. slow, depending, of course, on the size of meter, and would show a smaller amount of "unaccounted-for gas" than is actually lost.

Temperature and pressure, when referring to station meter and house meter, may show an increase in the "unaccounted-for gas," which is due to the temperature in the house probably being higher and the pressure certainly being lower than in the station meter.

Meters Tested in Situ.

Other types of meter, such as rotary and inferential, should be tested *in situ* where possible, so that the actual working conditions are experienced during test.

Meters which rely on the gas rotating vanes, if run in conjunction with a gas engine or other pulsating load, tend to run fast, due to the small increase in velocity of the gas over the mean velocity at each pulse. This speeding-up may be as much as 20 p.ct. at certain loads.

The remedy is to fit an anti-pulsator between the meter and the source of pulsation, when the meter will run within small limits of error.

Most undertakings have to purchase such commodities as water and electricity from outside sources, and it is advisable to have the meters through which these purchases are made checked periodically. Steam meters are found on some plants, and are useful in measuring consumptions to any particular source, such as retort steaming, thus allowing percentage steaming to be calculated. Steam is a commodity which slips out of sight very easily, and often a fairly large waste goes on unobserved. This may be in pipelines, inefficient engines, or steam traps blowing through, and an occasional check on consumption may reveal a waste which could be avoided. As much as 20 p.ct. of steam can be lost through such causes, resulting in increased steaming by the boilers being called for, with resultant increase in costs against the boiler plant.

Boiler Working Recorder.

In boiler working, a CO_2 recorder can be of great assistance in keeping a record of efficiency, and is a constant check on firing. A source of error in such instruments is often due to allowing the caustic potash or soda to become saturated with CO_2, if the solution be left too long in the instrument. Caustic potash is much better than soda, though a little dearer, for it will last from 10 to 14 days, depending on strength of solution and the number of tests made per hour.

One often sees various test results on different parts of plants quoted in technical papers, and sometimes when a comparison is drawn with results on some similar plant, a discrepancy occurs. Even differences on similar plants in the same works may be observed. These differences are usually put down against the plant itself, but they also may be due to the instruments employed during various tests not being accurate.

It is thus essential in carrying out any tests, whether for comparison with outside work or for general information, first of all to check the source of the data, or make certain that instruments employed are accurate, or that their error is allowed for in compiling results. The figures will then be of value, instead of misleading.

Regarding some of the more recent instruments which might be found useful in daily working and record keeping on most works, I should mention the following:

(1) Pressure recorder, showing the pull on retort bench.

(2) Pressure recorder, showing gas pressure in the holder.

(3) Pressure recorder, showing cycle of operations in the water gas plant.
(4) Pressure recorder, showing gas pressure on any district. This can also be arranged to be transmitted to works or other office if desired.
(5) Recording or spot reading pyrometer, giving temperature in any part of bench or flue.
(6) Thermometer, showing temperature of oxide in purifiers.
(7) Recording gravitometer, keeping a record of the Sp. Gr. of gas.
(8) Recording densimeter, showing Twaddell of liquor.
(9) Pressure recorder, showing steam pressure in boiler or part of range.
(10) CO_2 and CO recorder in boiler flue, producer, or waste gas flue, or on water gas "make."
(11) Recorder, to show H_2S, if and when present in gas.
(12) Barograph and recording thermometer on works, to keep record of pressure and temperature for correcting "makes" to S.T.P.
(13) Water or liquor flow meter and recorder, showing liquor to sulphate plant, &c.
(14) Optical pyrometer, for taking temperatures in combustion chambers of producers, in retorts, or boiler fire grates.

There are also a number of makes of C.V. recorders, including Beasley, "Sigma," and Fairweather.

I have mentioned some of my experiences with gauges, meters, and recorders, and brought to your notice a few of the modern developments in this class of instrument, but I have no doubt, that all of you have found some useful hints or ideas during working in your own particular spheres, and I hope that my paper may be useful in introducing a discussion on this subject, and so bring out those points for our mutual benefit.

Discussion.

Mr. GAVIN said he would consider that the addition of 10 p.ct. glycerine to the water in a holder seal would be out of the question for financial reasons. He asked for Mr. Rea's suggestion on how to get over difficulties with dirty tubes of gauges. In his experience cleaning with brushes lead to the snapping of glass as soon as the water was inserted.

Mr. HOUNAM (Edinburgh) said that Mr. Rea had informed them that in the single limb gauge a direct full-scale reading was given. This was not so; actually it measured less, and was found to vary with different manufacturers. He would be glad to know if there was any standard proportion.

Mr. D. GARRIE (Burntisland) said he would compliment Mr. Rea on having drawn attention to what was rather a neglected matter on many gas-works. These instruments were most useful if trouble developed, but often when recourse was made to them they were found out of order. Then, as soon as things were righted, they were laid aside and forgotten until faults again arose.

Mr. H. DUFF (Edinburgh) considered that if oil instead of water were adopted in gauges the difference in specific gravity would result in an inaccurate reading being given. The inclined gauge, he said, was used when taking dyamic pressures by means of the Pitot tube, because such pressure was an extremely small quantity, and the inclination provided quite a readable movement of the liquid.

Mr. J. SCOBIE (Dunfermline) suggested that for gauges subjected to the collection of dirt, a very small quantity—(say) 2 drops—of Siroil would be found very useful. It gave the water a good colour and would dissolve any impurity brought forward, and was itself soluble in water.

Mr. REA replied to the questions raised. He said he would agree that adding glycerine in the holder lutes would not be practicable on account of the cost. There could be no doubt that steam was the cheapest method of preventing freezing in such seals. Mention was made of this more particularly for purifier lutes, district governor seals, pressure gauges, &c. With regard to gauges he would suggest that two **U** tubes be employed; the first one to collect any impurity, and the second to give the reading. This, of course, would have the disadvantage of giving only half-scale readings. The single limb unit had the advantage over the **U** tube, since dirt was collected in the large area section and would not influence the actual reading limb. Mr. Scobie's suggestion to use Siroil, he said, was a good one.

The readings on single limb gauges, he should have said, were nominally full-scale, and were dependent on the ratio of the cross-sectional area of the two limbs. He considered that all gas undertakings would find gauges most useful, but unless they were looked after and not forgotten about they could not serve their useful purpose. He said that if a viscous oil were used in glass tubes, the liquid certainly tended to stick to the inner walls. He agreed that in gauges where use was made of any light oil in place of water, allowance for the difference in Sp. Gr. was, of necessity, made.

The PRESIDENT then brought the proceedings to a close by asking the members to accord a vote of thanks to Messrs. Warden and Rea for their extremely interesting contributions. These latter would provide a splendid reference in the Annual Transactions later.

JOINT MEETING OF THE YORKSHIRE JUNIOR AND THE MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATIONS.

The Annual Joint Meeting of the above Associations was held on Wednesday, March 20, when over a hundred members assembled at Wakefield in the early morning. Here motor buses were waiting to convey the party to Walton, where the New Sharlston Collieries Company, Ltd., in conjunction with Messrs. Arthur Wharton, Ltd., had invited the members to inspect the colliery and the modern screening plant. Mr. S. H. Packer, of Bradford, as President of the Yorkshire Association, was in charge of the party, while Mr. F. B. Small, of Liverpool, was the senior representative of the Manchester Association.

The New Sharlston Collieries, Ltd., were represented by Capt. W. M. B. Burnyeat, M.C., General Manager; Major J. G. Broackes, Commercial Manager; Mr. T. Roberts, Agent; Mr. E. Douglas, Chief Chemist; Major W. J. Evans, Chief Engineer; Mr. T. Morris, Chief Electrical Engineer; and Mr. R. W. Hall, Manager. Mr. Arthur Wharton, Mr. E. Towler, and Mr. R. Thompson represented Messrs. Arthur Wharton, Ltd.

Parties were formed, and conducted on a tour of inspection. Some of the groups devoted themselves to the screening and dry-cleaning plant above the ground, while others ventured below, and were conducted to the workings, from which coal was eventually sent up the shaft at approximately four tons per minute.

The screening equipment consists of three groups, and provision has been made for a fourth group to be added at a later date. Each group comprises two automatic power driven tipplers, two main jigging screens, two large coal belts, and one house coal belt, all with 21 ft. loading jibs. The nut slack is carried from the main screens to the auxiliary screening plant, which is also divided into three groups; each group consisting of a shaker screen for separating into nuts, peas, and slack. The nuts and peas are dry cleaned by means of spiral separators. A dust collecting plant is now in course of erection, to collect the dust from the spiral separator building.

At the close of the inspection, the members re-assembled, and were conveyed by motor buses to the Great Bull Hotel at Wakefield, for lunch as the guests of Messrs. Arthur Wharton, Ltd. Mr. S. H. Packer presided.

Mr. PACKER said that the first thing he had to do as President of the Yorkshire Association was to offer to their brothers from Manchester their deep and profound sympathy in the great loss which the Manchester Association had sustained by the death of their President, Mr. H. J. Hailstone. Proceeding, Mr. Packer said that it was his pleasure to extend a hearty welcome to the Manchester Association that day. He was extremely glad to see present Mr. C. S. Shapley, Senior Vice-President of the Institution of Gas Engineers. Mr. Shapley had always been a firm friend of the Junior Associations. Referring to the presence of his old chief, Mr. Charles Wood, Mr. Packer said that everyone present that day was delighted to find Mr. Wood looking so well; they wished him continuity of good health. He proceeded to move a vote of thanks to the New Sharlston Collieries, Ltd., and Arthur Wharton, Ltd.

Mr. F. B. SMALL seconded the vote on behalf of the Manchester Association.

Capt. W. M. B. BURNYEAT, M.C., acknowledged the vote; and Mr. ARTHUR WHARTON, in associating himself with the reply, referred to the service which the gas industry was rendering to the country.

Mr. C. S. SHAPLEY, the Engineer and General Manager of the Leeds Gas Department, said he appreciated very much indeed the kindly references which Mr. Packer had made.

The members then proceeded to the Wakefield Works of British Ropes, Ltd. (Messrs. George Cradock & Co., Ltd.), where they were conducted on a tour of inspection by Messrs. Sagar, Blake, and Town.

Afterwards Mr. PACKER voiced the thanks of the visitors to Messrs. British Ropes, Ltd., for their kindness in placing the works at the disposal of the meeting that day.

Mr. SMALL, seconding, paid tribute to the care and attention which was given to the testing of the ropes.

Mr. WILSON TOWN responded on behalf of British Ropes, Ltd.

GAS AT THE BRITISH INDUSTRIES FAIR.

Under the Chairmanship of Mr. R. B. Hodgson, a Meeting of the Local and National Committees of the Gas Industries Section of the British Industries Fair was held on March 13 at the Office of the Society of British Gas Industries.

The Hon. Secretary submitted a report of the Gas Industries Section at the 1929 Fair, and pointed out that the stand space occupied by the Section was 19,528 sq. ft., and this was taken up by 69 firms. In addition, applications for space were received from several firms in the industry who desired to exhibit; but these could not be dealt with owing to the allotted space in the Gas Section having already been taken up. The Hon. Secretary detailed the steps which were taken to secure Press publicity for the Section. This year the Gas Section received very good notices in all references to the Fair in the general Press.

A Representative of the Fair Management stated that attendance this year was slightly less than for 1928, which was attributed to the unfavourable weather conditions both here and abroad, and also to the prevalence of illness throughout the country.

Several members raised the question as to whether it would be possible for the Fair to be held later in the year, as it was felt that February was an inopportune time for gas engineers and others to visit the Fair.

The representatives of the Fair Management present stated that the date for the 1930 Fair had now been definitely fixed, and it would be held from Feb. 17 to 28, inclusive. They reminded members that in 1924 the Fair was held in May with a view to testing the general suitability of that time as compared with February, with the result that the Fair was not nearly so successful as when held in February. The Fair Management were also desirous of holding the British Industries Fair before the Leipzig Fair.

It was also pointed out to the meeting that it was an established custom in the gas industry to hold the Annual Meeting of the Institution of Gas Engineers in June each year, and for that reason it was not likely that any more gas buyers would be attracted to the British Industries Fair in May than in February.

Consideration was given to the organization of a Gas Industries Section for the 1930 Fair, and the Hon. Secretary reported that he had received a number of applications from manufacturers asking for particulars of space available for 1930, and whether new positions in the Section could be allocated to them. It was most desirable that something definite be done without delay.

On the proposition of Mr. R. B. Hodgson the following resolution was passed:

> That this Committee considers that the gas industry has definitely benefited by participating in the British Industries Fair as a properly organized Section, and recommends that steps are taken to organize a similar Section for 1930 Fair. And that Mr. R. J. Rogers is hereby instructed to write to the Institution of Gas Engineers, Society of British Gas Industries, British Commercial Gas Association, and National Gas Council, informing them of this recommendation, to the end that a representative committee may be appointed forthwith to take over all arrangements for a Gas Industries Section at the 1930 Fair.

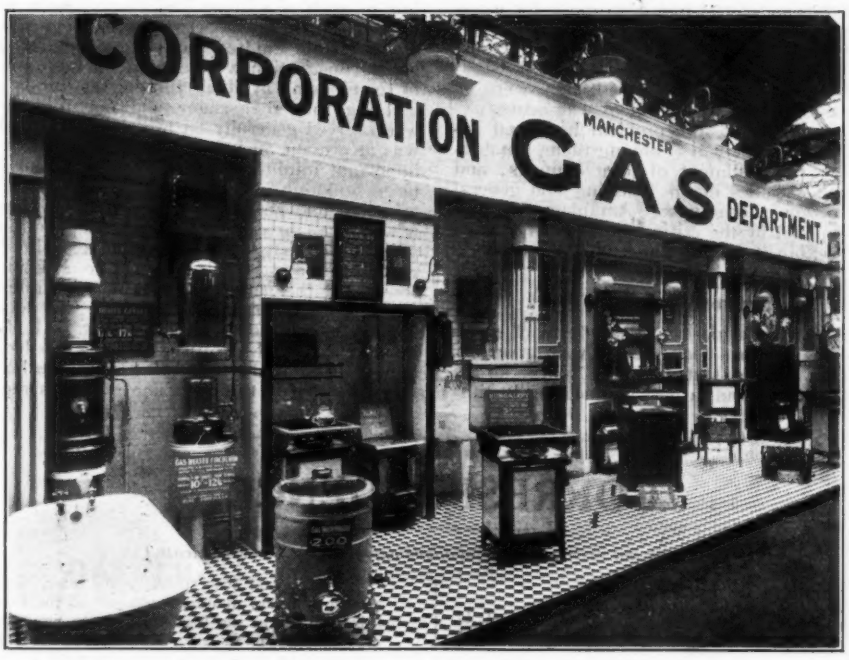
The Chairman also mentioned how much the industry was indebted to Mr. H. C. Smith for the work he had done in connection with the Joint Gas Conference; and the following resolution was passed:

> That this Committee desires to express its appreciation to the Joint Gas Conference Committee of the excellent manner in which the Joint Gas Conference was organized in Birmingham during the run of the British Industries Fair, 1929, and would especially record its thanks to Mr. H. C. Smith for the very large amount of work he carried out as Hon. Secretary to the Committee.

A vote of thanks was also passed to Mr. R. J. Rogers for the manner in which he had organized and carried through the Gas Industries Section for the 1929 Fair.

Mr. Rogers, in replying, urged manufacturers and everyone else in the industry to take a broad view of the value of the participation of the industry in the Fair. By combining in this way, manufacturers emphasized the importance of the gas industry in the commercial and domestic life of the country.

GAS STAND AT THE MANCHESTER HEALTH EXHIBITION.



The Manchester Corporation Gas Department took full advantage of the large and well-organized Health Exhibition recently concluded in the City Hall. A glance at their stand gave an idea of the enterprise and thought which they put into advancing the claims of gas for the maintenance of healthy hygienic homes.

Practical cookery demonstrations were held throughout the period of the Exhibition, and these ever-popular attractions never failed to draw a large and interested audience. There was also arranged a daily series of cookery competitions for the best dinner prepared in a gas cooker, the raw materials not to cost more than 2s. 6d. Ten of Richmonds' "Bungalow" cookers were specially fitted for these competitions, which proved a great success.

The Gas Department's stand contained a comprehensive display of cooking, heating, and water heating apparatus, conspicuous among which was Richmonds' "Bungalow" New World (in both black and "Rado" enamel finish), also their "Don" geyser, "Ironclad" circulating boiler, and "Marlborough" fire. Clarks' "Severn" cooker was also given prominence.

INSTITUTION OF CHEMICAL ENGINEERS.

Co-Ordination of Engineering Institutions.

At the Annual General Meeting of the Institution of Chemical Engineers held at Grosvenor House, Park Lane, London, on Wednesday, March 20, Mr. J. Arthur Reavell was elected President.

Sir Alexander Gibb (the retiring President) delivered an Address on "The Co-Ordination of Engineering Institutions and Societies."

It was obvious, he said, that there was a considerable wastage of effort, and a retardation of progress, caused by the almost haphazard dissemination of scientific effort in general, and engineering effort in particular, over the growing multitude of technical institutions and societies that now existed. So far as such societies were devoted to the promotion of the science of engineering, the overlapping and competition must inevitably in many ways hamper the attainment of the object. But there was a need—a very definite and indisputable need—for most, if not all, of these societies, and the value of small and specialized technical institutions was not always fully appreciated by the older and larger institutions. The problem, therefore, was not the reduction of the number of existing technical institutions and the prevention of further increase, but to find the best way to satisfy the different individual interests and at the same time secure all the advantages that lay in co-operation. At the present moment there were in this country more than one hundred institutions, institutes, societies, and associations devoted more or less directly to the science, subject, and practice of engineering, and there would be general agreement on the advantages to be gained from the greater concentration of these activities. These were, in the first place, an economy in actual expenditure on the provision of housing, libraries, records, and other facilities; secondly, the consolidation of professional interests and the improvement generally of the status of properly qualified engineers in the eyes of the world at large; thirdly, the provision of effective means of securing for the engineering profession the influence that it should have when political, departmental, or other interests threatened it; fourthly, the prevention of overlapping in intellectual effort and the co-ordination of scientific study and research; and lastly—and really the most important, being the chief reason and justification for the existence of all engineering institutions—the protection of the public from unqualified persons.

A very great deal of thought had been given to it by many most able minds, and various efforts had been made for many years past to find a complete answer. He proposed, therefore, to summarize what had been, and was being, done not only in this country but throughout the world, for though Great Britain was the first in the engineering world, they were by no means the only country where the problem was acute.

Taking their own country first, the problem had been approached in a number of different ways—among them, amalgamation; affiliation; the establishment of joint councils; and the grouping of kindred societies in one building and general co-ordination by registration or otherwise. Amalgamation was the obvious remedy proposed by the critic who had not studied the problem very closely; but it was not, and never would be, a solution.

Affiliation.

Affiliation was in some ways a more nebulous form of amalgamation. It had for many years been pressed with great enthusiasm by some as the only statesmanlike course to be adopted, and one of the oldest and largest engineering institutions laid certain proposals before the Institution of Chemical Engineers some while ago. At that time nothing eventuated, and it was found impossible to find a *modus vivendi* or formula that would meet the views of all parties. There appeared to be a lack of agreement, not so much as to what was desirable, but rather as to what was really involved in the proposal. There was considerable doubt as to what the term "affiliation" really connoted, and while there was in the mind of the authors some sort of idea analogous to that claimed to operate in our Empire, the Institution at any rate was unable to accept the idea of daughter and mother institutions, and in fact rejected the term "affiliation" altogether. The possibilities of the suggestion had yet to be fully explored, and it had been suggested that "federation" rather than "affiliation" was the proper line to adopt.

Establishment of Joint Councils.

As to the establishment of joint councils, at the present moment the only such council of whose working he could speak with any authority was the Engineering Joint Council. It had been in existence nearly seven years, but it could not be said that it had as yet obtained more than a very partial success. Membership in the first place had in practice been limited to the four founder Institutions—the Civil, Mechanical, and Electrical Engineers, and the Naval Architects, with only one new addition in this period; and secondly, the Council was definitely debarred from executive power or any initiative of discussions. It thus represented just those institutions most able to look after their own interests, and could scarcely act except in strict accordance with their directions. It had so far only secured one or two minor successes, but it was possible that its final position, if it were allowed to develop naturally, might be very different from that which it held to-day.

Grouping of Institutions.

The grouping of kindred institutions into one building was obviously, apart altogether from other and wider considerations, a very sensible and profitable policy. It had been done in America, notably in the Engineering Building in New York, where all the important engineering institutions were housed together and shared the library, information bureau, lecture halls, and other facilities. This arrangement owed its existence to the vision and generosity of a very wealthy man; and in the absence in this country of such benefactors, the financing of such a scheme had always been the main difficulty. Certain negotiations between the Council of the Institution and a certain kindred society, and another very large and important institution were carried on for some time with a view to rooms being available for the Institution's purposes in their building, but the scheme did not materialize, though they were agreed generally on principle. He understood that there was at present an important project on foot to unite the more important mining, fuel, and metallurgical institutions in one large building. The prospects seemed distinctly fair, as the principle had been agreed to by all concerned, and he hoped it would go through, for he could see nothing but good in the proposal. Whatever else was done, this should certainly be part of any and every scheme of co-ordination, but when they considered the actual contribution this offered to the solution of the real problem, he suggested it was actually comparatively small, though definitely important. It left practically untouched the problem of the waste of intellectual effort by overlapping, and of the weakening of the authority of engineering generally due to the confusion of voices representing it.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Stream Pollution by Liquid Manure.

Sir,—The following is an extract from an article by Messrs. W. G. Bainbridge and J. G. Parker, F.G.S., in the "Fishing Gazette" dated March 16, 1929.

> "We have had two serious losses by poisoning since taking over the fishing, both of which occurred during the spawning time. The first was caused by a liquid manure tank bursting at a farm on the head waters of our stream. As a result, all the trout for a mile-and-a-half were killed. It was a sorrowful sight to see the best of our stock murdered in so foul a manner. We took out of the stream and buried between 400 and 500 fish, the majority being from 1 lb. to 4 lbs. in weight. The damage did not end there. The poison killed all the food supply and that year's eggs; for when we came to examine the redds the eggs floated up white and dead. The poison had caught a late run of spawners in a low water.
>
> "The second loss, three years later, was also caused by an escape of liquid manure from one of the farms lower down, and this resulted in the loss of over 300 fine fish. In spite of these drawbacks, the fishery, although so near to the cotton mills, continues to provide its members with a fair amount of decent sport."

The two instances of poisoning referred to are very striking; and it would be advantageous for gas engineers and tar producers and distillers to keep in mind the serious effect of the leakage of liquid manure into fishing streams. There must be very few fishing streams which are not subject to the leakage of liquid manure from adjacent farms; and there is no doubt that the poisoning of fish has, in many instances, been attributed to the use of road tar when the cause of the poisoning should have been looked for elsewhere.

J. R. Bradshaw.

Hartlepool Gas and Water Company,
March 19, 1929.

PARLIAMENTARY INTELLIGENCE.

[From Our Special Correspondents.]

HOUSE OF COMMONS.

Holborn Gas Explosion.

Sir R. THOMAS asked the Minister of Transport if he could give an estimate of the date when the streets damaged by the gas explosion in Holborn were expected to be again open for traffic.

Col. ASHLEY replied that the Borough Council had let contracts for the whole of the road reinstatement, but this could not be commenced until the various statutory authorities had completed the work on their mains and services. The contracts provided for continuous working night and day; and it was hoped that High Holborn would be open to traffic in May, and the remainder of the streets a month later.

Production of Gas Mantles.

Sir HENRY JACKSON asked the President of the Board of Trade the production of gas mantles in this country during the last quarter of 1928, and, for comparison, the production during the last quarter of 1927, and the number of people employed in the industry during each of those periods.

Mr. HERBERT WILLIAMS (the Parliamentary Secretary to the Board of Trade) replied that complete data regarding the production of gas mantles in this country in the quarters specified were not available, but from the information he had received from the manufacturers, it was estimated that the numbers produced were about 107,000 gross in the last quarter of 1928, as compared with 91,000 gross in the corresponding quarter of 1927, and that the average numbers of workers in the two periods were approximately 2200 and 2000 respectively.

Sir H. JACKSON asked what were the number of hours worked in each of the two quarters.

Mr. WILLIAMS replied that he would require notice in order to give the exact figures. He added that he thought the regularity of work was higher in the latter than in the former period.

Mr. KELLY asked if he had any information regarding increases of wages paid during those two periods.

Mr. WILLIAMS replied that the total wages paid were higher in the latter period than in the former period.

Mr. BENN asked what was the sum total of the bonus which the users of gas mantles in this country had to pay to the German combine under the terms of the arrangement.

Mr. WILLIAMS said he was not acquainted with the amount of the bonus, but he was certain that if any other industry had been able to make a bargain so advantageous they would have done so.

Private Bills.

The opposition to the Aldershot Gas Bill and the Wandsworth, Wimbledon, and Epsom District Gas Bill has been withdrawn. The Aldershot Bill has passed the Committee Stage.

The South Suburban Gas Bill was brought from the Commons to the House of Lords, given a First Reading, and referred to the Examiners.

The Imperial Continental Gas Bill was read a second time.

The Sheffield Gas (Consolidation) Bill was read a second time in the House of Commons.

The Winchester Water and Gas Bill is still under consideration by the Local Legislation Committee in the House of Commons.

GAS UNDERTAKINGS BILL—REPORT STAGE.

House of Lords.—Thursday, March 21.

When the amendments to the Gas Undertaking Bill were reported,

Lord BANBURY OF SOUTHAM moved an amendment having for its object to make clear that, if money is borrowed on a certain security, more money shall not be borrowed on the same security. Whatever might be the opinions held, he thought it would be far better in the interests, not only of a gas company, but of all other undertakings of the kind, that this matter should be quite clear. If there was any doubt, people would not invest their money in the debenture stock of gas undertakings, because they would not be sure whether or not stock could be watered after they had bought it. He could not see that there was any harm in putting into the Bill a clause which would lay down quite clearly a straightforward provision to the effect that he had indicated.

Lord PARMOOR and Lord DANESFORT supported the amendment; the latter remarking that there was a possibility of litigation in this matter unless the point was made quite clear now.

The LORD CHANCELLOR said it was wholly unnecessary to pass the amendment. The clause in the Bill was one which dealt with the borrowing powers of an undertaking. It had nothing whatever to do with the priority of mortgages or debenture issues. It extended the borrowing powers, but said nothing as to the priority of moneys borrowed. It had been clearly settled by the authority of the House that, when there were successive Acts of Parliament giving borrowing powers one after the other to a public undertaking, the fact that a subsequent Act of Parliament gave further borrowing powers had no effect at all upon the security of those who had lent under the powers first conferred. Again, there were a number of gas companies operating under the Companies Act, and whose powers of borrowing were contained in their Memorandum and Articles of Association. If this proviso were carried in its present form, it would interfere with the right which they possessed of issuing further debentures. He hoped it would be realized that the position was reasonably plain, and that therefore an amendment would not be introduced which might create confusion and work injustice.

Lord BANBURY subsequently withdrew his amendment.

The MARQUESS OF READING, on behalf of Lord Melchett, then moved to insert after Clause 3 the following new clause:

Extension of powers of purchase of residual products.

(1) Any undertakers may, notwithstanding anything to the contrary contained in any Act or Order relating to them, purchase in such quantities as they think fit from any company, body, or person carrying on a gas undertaking (whether with or without statutory authority) or operating coke ovens or carrying on any process of carbonization or gasification of coal or coke any residuals arising from the manufacture of gas, or the carrying on of any such operation or process and products arising from a primary treatment of those residuals by such company, body, or person, and may exercise in relation to residuals or products so purchased the powers which would have been exercisable by them if such residuals or products had arisen in carrying on their gas undertaking in accordance with their statutory powers.

(2) The powers conferred by this section shall be in addition to and not in derogation of any powers conferred or to be conferred upon the undertakers by any Special Act.

He said that this amendment gave rise to no disagreement. It provided for the extension of powers of purchase of residual products; and he understood that the Government were prepared to accept the amendment.

The Earl of LUCAN confirmed the statement that the Government were prepared to accept this amendment, which, he said, it was understood had been reached by agreement between the National Gas Council and the chemical industries.

The amendment was thereupon agreed to.

The Earl of LUCAN subsequently moved to add to Clause 4 (Supply of gas by undertakers to premises outside the limits of supply) the following new sub-section:

(4) Notwithstanding anything in this section, every Order thereunder in respect of any undertakers shall be framed so as to secure that the provisions of the Gas-Works Clauses Act, 1847, with respect to the breaking-up of streets for the purpose of laying pipes, shall apply in relation to pipes for the supply of gas by the undertakers under the Order as they apply in relation to pipes for the supply of gas by the undertakers under the enactments applying to them before the making of the Order.

He said that this amendment was brought forward by the Government after negotiation and agreement with the railway companies, who rather feared that the Board of Trade might, under sub-section 2 of the clause, modify the usual provisions as to the breaking-up of roads.

The amendment was agreed to.

GAS LIGHT AND COKE COMPANY'S BILL.

The Unopposed Bills Committee of the House of Commons, over which Sir DENNIS HERBERT (Deputy-Chairman of Ways and Means) presided, considered this Bill on Thursday, March 21, and ordered it to be reported for third reading.

The main purpose of the Bill is to authorize the transfer to the Company of the undertakings of the Pinner Gas Company, Ltd., and the Grays and Tilbury Gas Company. The Bill also contains a number of clauses of an administrative character. (The principal provisions of the Bill were set out in the "JOURNAL" for Jan. 2, p. 40.)

Mr. C. E. C. BROWNE (of Messrs. Dyson, Bell, & Co., Parliamentary Agents) represented the Company in the Committee Room. The Pinner Company's area, he said, was situated on the extreme north-western border of the Gas Light and Coke Company's existing area of supply, and the Grays and Tilbury Company's area was near to, but did not immediately adjoin, the eastern boundary. The provisions of Part II. of the Bill, which part authorized the transfer, followed numerous precedents for similar amalgamations; there were no unusual clauses.

Between the eastern boundary of the Gas Light and Coke Company's existing area of supply and the area of the Grays and Tilbury Company there was a narrow peninsular of land, about a mile in width, in which the Romford Gas Company were authorized to supply. A clause was inserted in the Bill, therefore, to enable the Gas Light and Coke Company to lay the necessary mains for linking up their existing area of supply with the Grays and Tilbury area; and pro-

visions had been agreed with the Romford Company in order not to interfere with their interests.

Another clause dealt with the Company's right of entry into premises. Mr. Browne pointed out that section 21 of the Gas-Works (Clauses) Act, 1871, conferred certain rights of entry upon gas undertakers and their officers for the purpose of inspecting meters, fittings, and so on; but those powers had reference only to buildings or land lighted by gas. There were cases, however, in which gas was supplied not for lighting, but for heating, cooking, power, or stand-by purposes; and the Company now asked for similar rights of entry and inspection in such cases. The clause also proposed to empower the Company's officers to enter premises for the purpose of installing, fixing, or repairing apparatus "at the request of the occupier." Mr. Browne pointed out that the Company had on one or two occasions, though not frequently, encountered the difficulty that the tenant of a flat or tenement in a block of buildings wanted something done to his gas appliances, but the landlord, with perhaps a "bee in his bonnet," had refused to allow the Gas Company's workmen to enter the premises for the purpose.

There was another clause in the Bill relating to the testing of dried gas. This provided that, if the Company supplied gas from which the whole or part of the water vapour had been extracted, the Gas Referees should, in making any prescription under sub-section 1 of section 5 of the Gas Regulation Act, with reference to such gas, have due regard to that fact. The clause also made the necessary amendment to sub-section 7 of section 1 of the Gas Regulation Act in its application to the Company. The Gas Referees had approved of the proposal in the Bill, and the Board of Trade had raised no objection.

Another proposal in the Bill was to increase the remuneration of the Directors of the Company from £12,500 to £15,000. In support of this he pointed out that the two undertakings to be absorbed by the Gas Light and Coke Company would involve a considerable addition to the Company's present area, so that the result of the transfer would be to add very considerably to the responsibilities and duties of the Directors and Committees. Further, the output of gas by the Company was increasing from year to year, and he was informed that even on the enlarged basis of remuneration proposed by the clause, the cost of the Company's Directorate, per unit of gas sold, would be lower than that of any other gas undertaking in the country.

The Chairman asked what were the regulations with regard to the number of Directors.

Mr. Browne said the only provision was that there must not be less than seven; no maximum number was prescribed. The present number of Directors was seven. On previous occasions when the Company had amalgamated with others it had been made a condition of the absorption that one of the Directors of the absorbed undertaking should join the Board of the Company; but that was not so in this case.

Reports from the Board of Trade and the Home Office had been received with regard to the Bill. The Board of Trade had drawn attention to the fact that the number of enactments, not only for the Gas Light and Coke Company itself, but for Companies whose undertakings it had absorbed in the past, was very large; and it was very confusing to know what exactly the statutory powers were. Therefore, the Board had asked that the statutory enactments should be consolidated. The Company were only too anxious to comply with the Board of Trade's demand, if it were not pressed to do so within a prescribed limit of time; the Company wished to do it as soon as it possibly could, but it was a big task.

The Chairman said the Committee did not wish to place the Company under any obligation in this respect.

Mr. Browne said that another matter to which the Board of Trade had referred was that of the payment of compensation to Directors of the absorbed Companies for loss of office. It was invariably the provision, in connection with amalgamations, that such compensation should be paid to Directors who were turned out of employment thereby, and in some cases to the officials of the absorbed companies. The compensation provisions followed a large number of precedents; and there was nothing special in them. The Board of Trade had drawn attention to the fact that one of the gentlemen who would be compensated under the terms of this Bill had already received compensation from the Gas Light and Coke Company for loss of office on two previous occasions. That might be very fortunate for the gentleman concerned, said Mr. Browne, but he could not appreciate the bearing of the Board of Trade's remark. However, the Board had made no recommendation with regard to it.

With regard to the clause to extend the Company's right of entry into premises, the Board of Trade had asked the Committee to satisfy themselves that the clause was one which should be allowed to a particular undertaking rather than by amendment of the general law, and that the interests of the owners of premises and of consumers were safeguarded. The Home Office, however, had raised objection to the second part of the clause, giving the Company's officers power to enter premises for installing, fixing, or repairing apparatus, to whomsoever belonging—a power, enforceable by a penalty, to repair apparatus irrespective of the existence of any danger therefrom. Mr. Browne pointed out, however, that the power sought was a power to enter the premises only "at the request of the occupier."

The Committee allowed the clause.

Mr. Browne said the Home Office had suggested the insertion of a clause providing that notices should be given to the Commissioner of Police whenever the Company intended to break up a street or road within the Metropolitan Police district. The Company, he said, were not at present subject to that condition in regard to their existing area of supply. The only part of the area to which the Home Office now suggested the condition should apply was the Pinner Company's area. The Grays and Tilbury Company's area was outside the Metropolitan Police district, and the Home Office could not ask for the condition to be applied to the Gas Light and Coke Company's existing area, because no alterations were sought by the Bill in respect of that. The suggestion was that, merely because the Gas Light and Coke Company was to become the undertaker in the Pinner area (which was rural), this condition was to be applied. He did not deny that there were many precedents for the imposition of such a condition, but, he suggested, it was imposed in different circumstances. He added that there was the most complete and cordial co-operation between the Company and the police authorities.

The Committee did not impose the suggested condition.

Sir David Milne-Watson (Governor of the Company) proved the preamble of the Bill.

[A new provision has been inserted in the Bill, with regard to the proposed differential price to be charged in the Pinner area as distinct from the existing area of the Company. This provides that after June 30, 1942, the Gas Light and Coke Company or the Middlesex County Council, or the Ruislip-Northwood Urban District Council may apply to the Board of Trade for the reduction or cessation of the differential.]

WINCHESTER WATER AND GAS BILL.

House of Commons Committee.

Before Sir John Ganzoni, Bart. *(Chairman)*, *Mr.* Windsor, *Viscount* Sandon, *and Lord* Colum Crichton Stuart.

Monday, March 18.

The principal objects of the Bill are to extend the Winchester Water and Gas Company's limits of supply in respect of gas and water, to increase capital and borrowing powers, to confirm the use of lands for gas and water purposes, and to modernize the Company's statutory powers (see "Journal" for Jan. 30, p. 272). Counsel for the Bill were Mr. F. J. Wrottesley, K.C., the Hon. Stafford Cripps, K.C., and Mr. Jacques Abady.

There was opposition by the Winchester Corporation, who asked for a provision in the Bill giving them the right to purchase the Undertaking. Objections were also raised to some of the powers sought by the Company. The Corporation were represented by Mr. W. J. Jeeves, K.C., and Mr. F. N. Keen.

Mr. Wrottesley, in opening the Bill, addressed the Committee for the greater part of the first day's hearing, and discussed in some detail the history of the Company, which was incorporated in 1865, to take the place of a former water works company and a gas company. In 1903 the limits for the supply of gas and water had been extended, but there had been no extensions since; and extension had become desirable in view of the developments in the area. The limits for the supply of gas extended beyond the limits for the supply of water at present, as would be the case also if the powers now sought were granted.

Discussing gas supply, he said that in two of the parishes in respect of which statutory powers were now sought—namely, Littleton and Sparsholt—supplies were already being given.

There was a clause in the Bill giving the Company power to enter into agreements for specified purposes, and, with the consent of the Board of Trade, with undertakers authorized to supply gas under Parliamentary powers in any district adjacent to the gas limits of the Company. This clause would enable the Company to co-operate with other gas companies. In another clause the Company sought power to exchange stocks, shares, and securities with, or lend money to, undertakers with whom they might have entered into agreements. With regard to this position, the Board of Trade, in a report, had pointed out that in the Dover Gas Act of 1928 the Dover Gas Company were required to obtain the approval of the Board as to the amount of money which could be lent to other companies; and in the Shirebrook Gas Order of 1928 the undertakers concerned were required to obtain the approval of the Board before lending money to other companies. This proviso, said Counsel, was reasonable, and the Winchester Company had given effect to it in their Bill.

Discussing capital, he said the Company was a maximum dividend concern, the maximum dividend on the old ordinary and preference capital raised prior to the war being 5 p.ct., with the exception of some which was raised at a higher rate and afterwards converted. Substantial premiums had been obtained, to the extent of something like £14,000 on about £150,000 worth of stock. The total capital debt raised (ordinary and preference, including premiums) was £248,110, and £103,714 had been borrowed. The cash received altogether was less than that, because capital had been raised at a percentage higher than 5, but had been converted to 5 p.ct. The cash received was £280,214, and the Company's capital powers were exhausted. The Bill sought to authorize additional ordinary and/or preference capital of £80,000, the maximum dividend to be 6 p.ct., unless in any year a larger dividend be necessary to make up a previous deficiency. It was thought wise to ask for a maximum dividend of 6 p.ct. on the new capital in order to ensure that the

Company would be able to raise the money at par. The present price of the 5 p.ct. stock was 80.

The CHAIRMAN said it was proposed to make a sort of cumulative ordinary stock.

Mr. WROTTESLEY replied that this was the position of the stock of this Company, and, he believed, on the stock in most other maximum dividend companies there was a right to pay back dividends. It was often desirable not to pay a full dividend in any year. Instead of trying to raise charges to the public, and using the maximum powers, it was sometimes desirable in lean periods to forego dividends and look to the future to reimburse the shareholders.

With regard to borrowing powers, it was proposed that the Company be empowered to borrow up to half the amount of the new capital, £40,000, and to increase the borrowing powers possessed prior to the passing of the Bill to half the amount of the capital issued under existing powers, so that they would be empowered to borrow another £20,341. Thus, under the powers of the Bill the Company would have power to raise altogether another £140,000 by the issue of stock and by borrowing, in respect of the gas and water undertakings. Having regard to the rate of progress in the past, and the reasonable requirements of the area, this would last about eighteen years.

Until 1922 the capital accounts of the gas and water undertakings were not kept separately, but since 1922 they had been separated. The financial advisers of the Corporation and the Company had disentangled to some extent the old history of the capital of the Company, and the parties had agreed that up to the end of last year the capital expenditure on the gas undertaking was £150,000, and on the water undertaking £114,017. Of the new capital proposed to be raised, £100,000 would be required for the gas undertaking, and £40,000 for the water undertaking. The output of the gas undertaking had been growing at the rate of about 5 p.ct. per annum, and it was estimated that the new capital powers would be sufficient for about 11½ years at the normal rate of expansion.

Powers were sought in the Bill to create a renewals fund and a special purposes fund. The Board of Trade, in a report, had stated that the power to create these two funds was usually allowed only to sliding scale companies. Such a company was prohibited from maintaining a reserve fund, under section 31 of the Gas-Works (Clauses) Act of 1847, for this fund was applicable to purposes similar to those for which the special purposes fund might be used. Counsel pointed out that the reserve fund could be made only out of an excess of profits above the amount necessary for the paying of dividends, and it was limited to the purposes of equalizing dividends and meeting any extraordinary payments or demands which might arise against them. Neither the renewal fund nor the special purposes fund could be directed to the equalization of dividend. The Board of Trade appeared not to have appreciated the objects of the funds. Contingencies, such as accidents, strikes, and so on, might prevent the Company paying maximum dividends, and the Company asked for power to establish the renewal and special purposes funds on the ground that it was desirable that any public utility company should be able to raise money at the lowest possible rate.

With regard to administration, power was sought to adopt schemes to enable employees to participate in the profits of the Company; to take houses, cottages, and other buildings for the employees; and to purchase a recreation ground.

The Winchester Corporation, in their petition, had asked that, as a condition of securing any further statutory powers, the Company should be required by Parliament to conduct their water and gas undertakings separately, and to keep separate accounts both on capital and revenue account with regard to the two undertakings. This, said Counsel, had been done for some years, by agreement. The Corporation also asked for the insertion in the Bill of provisions to enable them to purchase the undertaking of the Company with regard to both the supply of gas and the supply of water. It was also suggested in the petition that differential charges for gas and water should be charged in the areas to be added to the limits of supply.

Col. *W. B. Simonds* (Chairman of the Company) gave evidence, and said that the application of the Company to extend the areas of supply for gas and water was made as the result of applications from those areas that supplies should be given. The Company were at present supplying gas beyond their statutory limits, and asked for powers to extend the gas supply into the parishes of Littleton, Crawley, Sparsholt, Lainston, and Hursley, all of which were conveniently placed, in relation to the existing mains, for giving a supply. With regard to the Corporation's application for powers to purchase the undertaking, he said the Company had received no complaints from the Corporation before the petition was deposited.

Mr. W. J. JEEVES, K.C. (for the Corporation), cross-examining, referred to the Company's proposal to raise the proposed new capital at 6 p.ct., and suggested that, if it were raised with the security of the Corporation behind it, they would get it at 5 p.ct. or under; and this would be an advantage to the community.

Tuesday, March 19.

Mr. *Arthur Valon* (of Messrs. W. A. Valon & Son, Consulting Engineer to the Company) gave evidence, and said that the total quantity of gas sold in 1928 was 190 million c.ft., and the number of consumers was 5730. The average increase in gas supplied during the past five years had been at the rate of 5 p.ct. The new capital asked for the gas undertaking was £116,500, or the moderate figure of £800 per million; the increase at the existing rate of 5 p.ct. implying an increased consumption of 145 million c.ft. On this basis the new capital would last 11½ years, or thirteen years if the increase were at the rate of 4½ p.ct.

Cross-examined by Mr. Jeeves, Mr. Valon said he had not detailed estimates of new plant for extensions of the gas-works, but had given a general figure based on the estimated requirements in view of past developments. Mr. Jeeves put it that on the basis of the increased output of gas in 1928, the amount of new gas capital asked for would last a period of 16 years. Mr. Valon replied that he would never base the future increase on the figures of the one previous year.

Mr. *H. C. Head* (Engineer and General Manager of the Company since 1904) said that during the first two months of this year the increase in gas supply had been at the rate of 16 p.ct. as compared with 1928; and in spite of the milder weather of the last two or three weeks, this rate was still being maintained. Therefore, he did not think it could be said that the new capital asked for was excessive, or that the rate of increase of 5 p.ct. which had been adopted was too high.

Wednesday, March 20.

Mr. *Arthur Collins* (Financial Adviser to the Winchester Corporation) gave evidence as to the propriety of the Corporation's proposal to purchase the Company's undertaking. His view was that if the Corporation could satisfy the Committee that it was in the public interest that the water supply should be in public hands, the Corporation could ensure to every shareholder in the Company not less annual dividend than that which he was getting at present; could compensate all the officials and Directors; and carry on the undertaking without increasing the water rate.

Mr. JACQUES ABADY, cross-examining, suggested that the question of purchase was not seriously considered by Mr. Collins on behalf of the Corporation until after the Corporation's petition was filed on Feb. 12 (the resolution of the Finance Committee with regard to the petition having been that a petition be lodged in order that protective clauses should be obtained).

Mr. *Collins* replied that this was going too far.

In reply to further questions, Mr. Collins said the date of his report on the subject of purchase was Feb. 27.

The CHAIRMAN said that if no purchase clause were put into the Bill, its omission would in no way prevent the Corporation promoting their own Bill next year or at any other time to purchase the undertaking.

Mr. ABADY said that this was a question of procedure of course; he was going to submit that there was nothing to prevent them.

Mr. JEEVES said the point was that the clause for which the Corporation were asking provided that the Company should not offer any objection to the purchase except on matters of detail. Therefore, the decision in effect would be that the Committee had approved purchase by the Corporation on fair terms, and that, subject to fair terms being arranged, the Company were to oppose only for the purpose of protecting themselves on matters of detail.

He then addressed the Committee, and referred to a large number of Acts which had been passed, enabling local authorities to take over gas undertakings, water undertakings, and sometimes combined undertakings, to show the trend of public policy in that direction. They showed the definite recognition of the public policy, providing either that the powers of the present Bill be suspended, and that if the Corporation presented a Bill in the next session of Parliament they should be entitled to purchase on arbitration terms or agreed terms; or, alternatively, that the Corporation should be granted a clause providing that if they promoted a Bill it should not be prejudiced by anything in the present Bill. In some of the cases he referred to it had been mentioned by the Parliamentary Committees concerned that the insertion of the clauses was not by reason of any complaint of the Company undertakings, but really in deference to recognized public policy.

In reply to a question by Mr. Wrottesley, he agreed that some of the purchase clauses had been inserted by agreement between the parties, and some by decision of Parliament. He added that if Parliament were to approve of the insertion of such clauses only when there was agreement, it would mean that the companies would have a permanent monopoly in their undertakings, and that they were not to be compelled to part with them except upon the price agreed by them. It would enable them to say they would not sell, unless at an extravagant price. This was not a position which would ever be accepted by Parliament. He also pointed out that the Winchester Corporation were concerned with the repair of the roads, and had to deal with electricity and sewerage; and if the water and gas undertakings were in their hands also, all the causes for the disturbance of roads would be in the hands of the authority who were responsible for the maintenance and upkeep of the roads.

Without calling upon Counsel for the Company to address them, the Committee conferred, and announced that they had found the preamble of the Bill proved.

The proceedings were then adjourned until Monday, March 25, to give the parties an opportunity of agreeing on some outstanding matters on which the Corporation had asked for protection.

Monday, March 25.

There was considerable discussion when the Committee met on Monday to consider outstanding matters and to pass the clauses of the Bill. Some of the points raised related to water, while others concerned both gas and water matters.

With regard to capital, the Company asked originally for powers to raise an additional £80,000 of share capital, and power to borrow to the extent of half the capital issued. The Corporation had suggested that the additional capital asked for was too much. The Company now intimated that they would be content with additional capital powers to the extent of £70,000, with 50 p.ct. borrowing powers; and this figure was agreed to.

In connection with a clause to empower the Company to take lands by agreement, the Corporation asked for a proviso that this should not interfere with any town-planning scheme brought forward by the Corporation. It was pointed out by the Company, however, that the Ministry of Health had necessary powers with regard to town-planning. The proviso was not inserted.

MISCELLANEOUS NEWS.

RADIATION LIMITED.

The Fruits of Research.

The Annual Meeting of Radiation Limited was held on Monday last at the Cannon Street Hotel, E.C.; Mr. H. JAMES YATES, the Chairman, presiding.

Mr. H. JAMES YATES, moving the adoption of the report and accounts, said that last year the Directors had included a statement showing the combined assets and liabilities of the constituent Companies of the firm, and the details gave considerably more information than was required under the new Companies Act, which would shortly come into force; but it was thought the proprietors would prefer—anyway for this year—to have the information in all its detail as last year.

The balance-sheet naturally did not contain the full information given in the combined statement of the constituent Companies; and therefore he proposed dealing with that combined statement. Taking first the liabilities—the item for debentures in the constituent Companies had been reduced from £54,100 to £53,450, as some debentures had been purchased during the past year. The item of £386,959 for sundry creditors and credit balances, including taxation reserves, compared with £385,795 in the previous statement, and did not call for comment. The item of £2,392,075, cost to Radiation of the whole of the shares of the constituent Companies, was the same as last year, and also appeared on the assets side of the Radiation balance-sheet. Amount due to Radiation Limited by constituent Companies, £1,242,825, consisted of dividend for 1928 declared and to be paid over by the constituent Companies; the balance of their dividends for past years not paid over; charges paid in the first instance by Radiation on behalf of the constituent Companies, and charged by them to the Companies; and loans by Radiation to the Companies.

As regards the assets, taking first the items freehold and leasehold land, buildings, plant, machinery, fixtures, &c., more land had been acquired and extensive additions made, with the result that, after making the usual liberal deductions for depreciation, a net increase of £46,990 was shown in the assets as compared with the previous year. On the other hand, investments at £1,365,003 were £58,005 less than last year, the result of certain realizations, and of provision against depreciation in value of gilt-edged investments which were evidencing themselves as a result of the increased bank rate and other conditions. Sundry debtors and debit balances had increased by £27,042, and cash at bank and in hand had increased by £53,754, while stocks had decreased by £11,062. As regards stocks, great care was always exercised to scrap anything out of date; and the stocks had been valued at cost or market price, whichever was the lower. Against the figure of goodwill, £901,724, they had now in the constituent Companies undistributed profits retained to credit of their profit and loss accounts to the sum of £667,811, as compared wth £618,710 last year. Further progress had therefore been made, to the extent of £49,101, towards replacing the total cost of goodwill by tangible assets—a course which he was sure would appeal to shareholders as prudent and desirable.

During the past year in some sections of the business they had been up against the keenest and most foolish competition. Naturally this competition had had to be met, and as a result they had had to supply certain goods at prime cost—indeed, in some cases even at a lower figure—so that the prices obtained in such cases did not enable them to recover overhead charges, to say nothing of being unable to make a profit. For these reasons the profits for the past year had suffered. In addition to these difficulties, the Directors were obliged to give much time and attention to the events of a year ago, to which he did not desire to make any further reference except to say that it was hoped those matters were now finally closed. He was pleased to state that so far this year trading results showed a very satisfactory increase on last year.

It had been decided to hold the meetings in future in London. There appeared to be an impression in some quarters that the greater proportion of the shareholders were in the Birmingham district; but this impression was erroneous, and the Directors were satisfied that London suited the convenience of the majority. Incidentally, the Head Office of the Company was in London; they only had the Registered Offices in Birmingham as a matter of convenience and economy, as the Registrar's Department was located there.

As to the work during the preceding twelve months, he had made reference last year to an investigation on which they had been engaged for a number of years past, having for its object an examination of the possibility of improving the quality of heat emitted by the gas-fire; and before telling them the successful result of this investigation, he would explain briefly what was meant by improving the quality of heat. Everyone would agree that the heat experienced when in the sunshine was more pleasant than that felt when sitting in front of a domestic fire of any type; and it was well known that the human body could bear without discomfort a greater intensity of the sun's heat than of that emitted by any other form of heating. This effect was due to the difference which existed between the quality of the heat reaching people from the sun and that emitted by the various types of domestic fires; hence if something of that distinctive feature of the sun's heat could be imparted to the heat given out by a gas-fire, a greater degree of comfort would be ensured. Now energy radiated from a source travelled like series of waves through the other, and the character of the energy was determined by its wave length. A source of heat, such as the sun or a domestic fire, emitted a wide range of waves. Light (visible rays) was the name given to that series of waves of energy to which the eye was sensitive, but it was only in respect of wave length that light differed from the longer (invisible) rays to which were attributed the sensation of heat. In technical language these latter were called infra-red rays, and were further sub-divided and spoken of as short infra-red and long infra-red rays. A domestic fire emitted both visible rays and infra-red rays, but much the greater portion of the energy was in the form of these invisible heat rays. Short infra-red rays, when they fell on the surface of the human body, penetrated more deeply than did the long infra-red rays, and the visible rays penetrated more deeply than either. The sun's energy had the power of penetrating the outer layer of the skin and getting directly to the nerve ends which lay very near the surface, and also of travelling through to the fine blood capillaries which lay immediately underneath. This was mainly due to the visible and the short infra-red rays; and as a result of their research work they had succeeded in producing a new radiant which provided a more congenial warmth, and the scorching and drying sensation that was often experienced when sitting in front of a domestic fire had been done away with.

The research which this had involved had been long and costly; and once it reached the stage when it enabled them to produce a gas-fire radiant so greatly in advance of anything hitherto made, they felt that the time had come for putting on the market this new radiant, which was called the "Thermo-XX Beam." It was strictly interchangeable with its predecessor the "Thermo-XX" radiant, which up to the present had proved to be the most efficient gas-fire radiant made. The new radiants could be obtained from any gas undertaking, and could be fitted in place of the "Thermo-XX" radiants in existing Radiation "injector-ventilator" gas-fires. The new "Thermo-XX Beam" radiants had had a remarkable reception, not only from the gas industry, but among medical men and the general public. A number of the proprietors would have read a very interesting letter which appeared in "The Times" on Jan. 29 last, from Prof. Leonard Hill, the well-known physiologist, regarding tests made at the Zoological Gardens on the effects of radiant heat upon certain animals. In that letter he mentioned the new "Thermo-XX Beam" radiants, and he also referred to the research work that had been carried on in the Radiation Laboratories. It was gratifying to find that work and its results thus recognized by so eminent an authority. They were continuing to pursue their ultimate ideal, which was to make a gas-fire that would give the beneficial effect of sunshine in every home. The Radiation "injector-ventilator" gas-fire fitted with this new "Thermo-XX Beam" radiant was hygienically perfect. It warmed the room and at the same time ventilated it, thus being the means of causing the admission of cool and fresh air to the room.

"Radiation" was an organization that never rested; and this was well exemplified by the continued developments in all the various apparatus they made, and in particular in the "New World" cooker. Its introduction some years ago was recognized in the gas industry as marking an epoch; and ever since that date they had experimented continuously to bring about still further improvements. They were now introducing a new type of hotplate. This would be known as the "Disc-Bar;" and, while still maintaining the highest economy, it greatly improved the general utility of the hotplate, and upheld that high hygienic standard which they had set themselves.

Some years ago, when they introduced the "New World" cooker, and with it the "Regulo," which enabled automatic control of the oven to be effected, he had prophesied that the day would come when no gas oven would be used without some form of automatic control. This prophecy was being borne out, and to-day it was an exception to supply a "New World" cooker without the "Regulo." He had no hesitation in saying that the "Regulo" was the only absolutely reliable automatic control made to-day. All that the housewife had to do was to place the food in the oven, set the "Regulo" at the prescribed mark, and after the lapse of the necessary time remove the food perfectly cooked. Another feature of the "New World" cookers was the mottled enamel finish. In their Research Laboratories for years past they had been endeavouring to produce, for cast iron, an enamel which would stand up to everyday hard usage. They had been successful, and practically the whole of the "New World" cookers to-day were supplied in their special mottled enamel finish. Apart from the improvement in the appearance, the enamel required very little labour to keep it clean.

In his (Mr. Yates') opinion the Patent Laws of this country did not provide inventors with the same degree of protection as was to be obtained in other industrial countries, notably the U.S.A. Many of the developments in Radiation apparatus had been the result of long-continued and costly research, in some cases covering a period of years. When they had reached their goal, they had frequently found themselves in the unfortunate position of not being able to retain for themselves the results of their great expenditure and pioneer work; the results became at once available to those competitors who made no corresponding contributions to the progress they had thus effected. Recently they were compelled to take action in respect of what they contended, and were advised, was an infringement of one of their valuable inventions, which enabled their

gas-fires to heat and ventilate rooms hygienically—a thing which, prior to this invention, had not been possible. Unfortunately, owing to the existing state of the Patent Law in this country, they were unable to sustain the action. It happened, however, that the patent covering this invention, which had been a most valuable asset to the Company, was approaching the end of its period; and the loss to the Company was therefore relatively small, as developments on hand fully assured their continuing to hold the premier position in all the types of apparatus they made. The Board would continue to take every step which they considered essential to protect their inventions and designs, and to prevent the use of any name which could be regarded as trespassing upon or infringing their rights, especially having regard to the energies—representing years of work—which had been spent, and the great expenditure which had been incurred, in the extensive research work carried out.

The proprietors would remember that an Extraordinary General Meeting was held on Oct. 11 last, and the Confirmatory Meeting was held on Oct. 26, for the purpose of revising the Articles of the Company, when provision was made for the annual retirement of one-third of the Directors liable to retire. This year it fell to Messrs. T. B. Peattie and Edward Markwick to retire; and being eligible they offered themselves for re-election.

He would like again to take the opportunity of expressing appreciative thanks, on behalf of himself and his co-Directors, for the continued loyalty and service shown by the workpeople and various staffs during the past year.

Mr. Yates then moved: "That the report and balance-sheet for the year ended Dec. 31, 1928, as presented by the Directors, be received and adopted, and that final dividends be declared as follows, and paid on April 12, 1929: 3 p.ct. to Dec. 31, 1928, on the 6 p.ct. cumulative preference shares, *less* income-tax, and 9⅜ p.ct., *less* income-tax, on the ordinary shares, making, with the interim dividend paid in October, 1928, a total dividend of 12½ p.ct. on the ordinary shares for the year."

Sir DAVID BROOKS seconded the motion, and, the CHAIRMAN having replied to questions, it was put to the meeting and carried *nem. con.*

The retiring Directors (Mr. Edward Markwick and Mr. T. B. Peattie) and the Auditors (Messrs. Peat, Marwick, Mitchell, & Co.) having been re-elected, the proceedings terminated.

GAS COMPANIES' RESULTS IN 1928.

Continued Prosperity Throughout the Country.

ALNWICK.

At the Annual Meeting of the Alnwick Gas Company, Mr. K. Kyle, the Chairman, reported that the output had been maintained. Though the reductions in the price of gas made by the Company last year had lessened the cash receipts, the lower price of coal had offset that to a certain extent, while sales of cookers and fires had also risen considerably. The profit and loss account showed that, after paying the interim dividends and adding £200 to reserve, there remained £3654, out of which the Directors decided to pay a final dividend on "A" stock of 7½ p.ct.; "B" stock, 6 p.ct.; and "C" preference stock, 3 p.ct., making 12½ p.ct., 9½ p.ct., and 6 p.ct. respectively for the year.

BLYTH.

At the Annual Meeting of the Blyth Gas Company, Mr. Alexander Watt, the Chairman, said that the income had been £43,720, and the expenditure £34,962, which left a profit of £8757. There had been a saving of £3515 on coal compared with the previous year, but it had been largely discounted by the lower revenue from bye-products. Coal to the amount of 11,233 tons had been carbonized, and the quantity of gas accounted for was 16,454 c.ft. per ton of coal. The reserve fund account had been increased by £1225, and now stood at £6983. A dividend of £3 17s. 6d. p.ct. for the half-year was approved.

BARNARD CASTLE.

At the Annual Meeting of the Barnard Castle Gas Company the profit and loss account showed an available balance of £1291, and dividends at the rate of 5 p.ct. per annum on the original consolidated stock and £3 11s. 5d. p.ct. on the new ordinary stock were declared, leaving £1031 to be carried forward. The quantity of gas sold had increased, but the price had been reduced. A sum of £500 had been spent on improvements.

GOSPORT.

At the Annual Meeting of the Gosport District Gas Company on March 13, the Chairman, Mr. W. E. Churcher, referred to the loss sustained by the death of Mr. G. Snook, who had been a Director of the Company for 28 years and the Deputy-Chairman since 1926. Mr. Snook, he added, had always taken a very keen interest in the Company's affairs. The vacancy on the Board had been filled by Mr. L. J. Parham, who had been identified with the public life of the town for a long period. In moving the adoption of the report and accounts, the Chairman said that the quantity of gas sold during 1928 showed an increase of 17 million c.ft. over 1927, when the increase had been 11 million c.ft. over the preceding year. During the exceptionally cold spell recently experienced, the quantity of gas sent out from their works increased during one week by 28 p.ct., and on one particular day the increase was 34 p.ct. Only three complaints were received from their 10,470 customers, and it was a tribute to their administration that these unusual demands had been so completely met. Apart from the elasticity of the gas producing capacity, a prominent part had been played by the new gasholder which had recently been completed, and which enabled them to meet the situation with additional security. The Chairman explained that the increased expenditure on the capital account was largely due to the new gasholder, but on the other side of the account they had received rather more than £27,000 of new capital. The revenue account showed a further reduction in the charges for coal, but there was also a slight decrease in the revenue from residuals. In the account, the sum of £731 had been charged in respect of the Gosport and District Gas Orders, 1924 and 1928. The profit for the year constituted a record, amounting to £14,382, compared with £12,208 for the previous year. In view of the satisfactory working revealed by the accounts, he had much pleasure in announcing that as from the end of the present March quarter, the price of gas would be reduced in all districts of the Company's area of supply by 0·6 of a penny per therm, which was equivalent to practically 2½d. per 1000 c.ft. In the Fareham district, where the price was regulated by the 1924 Order in relation to the quantity used, a further reduction of 0·2d. per therm became operative as and from Jan. 1 last, in consequence of the increased sales. The turnover of the Sales Department was rather less than in the previous year, owing to the slower rate of building in the district caused by the reduction of the housing subsidy, but the number of appliances in use had increased during the year by 1198, and the number of consumers had gone up by 451. To provide for the convenience of consumers at Lee-on-the Solent, a new branch showroom was opened there towards the end of December. The Directors recommended the payment of the maximum dividends permitted by the price of gas ruling during the year—namely, 5 p.ct. on the preference stock and £7 1s. p.ct. on the consolidated ordinary stock. Mr. T. H. Whicher seconded the motion, which was carried unanimously. Referring to the strong financial position of the Company, Mr. A. T. Gilbert (London) said that whereas in most companies of similar size the capital charges amounted to £1000 per million c.ft. of gas sold, at Gosport they were only £583.

LONDONDERRY.

In the centenary year of its existence the Londonderry Gas Light Company had the satisfaction of reporting a year of record sales. At the Annual Meeting of the shareholders, Mr. R. H. Smyth (Chairman of Directors) recalled that the Company was established in 1829, and incorporated by Act of Parliament in 1877. The sales of gas over the past year were the highest in the one hundred years' existence of the Company. The increased output was nearly 7 million c.ft. over that of the previous year; and another gratifying achievement was that the thermal yield obtained per ton of coal carbonized was the highest recorded in the history of the Company, comparing most favourably with other gas-works. Nearly 400 new consumers were connected during the year; while 300 cookers and over 200 gas fires and heating appliances were sold. In view of the ever-increasing competition and the general depression of trade the results were exceedingly good, and reflected credit on the management, staff, and all employees. Mr. G. Walmsley (Engineer and Manager) acknowledged the vote of thanks.

LOWESTOFT.

The Directors' report of the Lowestoft Gas and Water Company shows an available balance of £18,782, and the payment of the following dividends for the year is recommended: On the ordinary shares at the rate of 10 p.ct. per annum; and on the additional ordinary shares at the rate of 7 p.ct. per annum. On Oct. 1 last interim dividends were paid, the rate being 5 p.ct. in respect of the ordinary shares, and 3½ p.ct. in respect of the additional ordinary shares. The final dividends will absorb £8145, leaving the sum of £10,637 to be carried forward to the next account.

MATLOCK.

At the Annual Meeting of the Matlock (Derbyshire) and District Gas Company, Mr. E. H. Bailey presided in the absence of the Chairman, Mr. Tom H. Wright. It was stated that the reductions made in the price of gas last year cost the Company £3000. Another drop of 2½d. per 1000 c.ft. was made on Jan. 1, and this would further reduce their income for the coming year. A dividend of 7¾ p.ct. was declared.

ROSSENDALE.

The Directors' report of the Rossendale Union Gas Company for the year ended Dec. 31, 1928, shows that statutory dividends are announced on the several classes of shares, *less* income-tax.

SEAHAM.

Mr. Malcolm Dillon presided at the Annual Meeting of the Seaham Gas and Lighting Company (Co. Durham) on March 19. The report and accounts showed a profit of £2643, which, with

£1591 brought forward, made a total of £4235. After meeting interest on mortgages and payment of the half-year's interest there was £2829 to carry forward. Dividends of 8 p.ct. per annum on "A" stock and "B" shares, 6 p.ct. per annum on "C" stock, and 4½ p.ct. on the preference stock, *less* interim dividend paid during 1928, were recommended. The Chairman said that the burden of local rates represented nearly 7d. in the £ per 1000 c.ft. of gas sold. Revenue from gas sold was down by £3131, partly due to reduced price of gas and partly to lessened sales consequent on the introduction of electricity into the district, the public lighting having been converted from electricity to gas.

SHANKLIN.

The Directors of the Shanklin Gas Company submit the following report for the year ended Dec. 31, 1928. The balance standing to the credit of the profit and loss account is £11,887, after payment of an interim dividend of 3 p.ct., *less* income-tax. The Directors recommend the declaration of a final dividend of 5 p.ct. for the half-year, making 8 p.ct. for the year, *less* income-tax. There has been an increase in the sale of gas over the year 1927 of 1,695,200 c.ft., equal to 3 p.ct. The Directors are prepared to consider offers for £2750 of ordinary stock, being the balance unissued of the £10,000 authorized in 1925.

SLEAFORD.

The Directors of the Sleaford Gas Company, in their report for the year ended Dec. 31, 1928, announce a dividend at the rate of 10 p.ct. for the year free of tax.

SOLIHULL.

At the Annual Meeting of the Solihull Gas Company, Mr. Edmund Allday, the Chairman, stated that the past year had been one of rapid progress. The output of gas had been the largest since the Company was established. An addition of £5000 had been made to plant, mains, &c., and a large outlay in additional plant and mains would have to be carried out during the present year.

SOUTHAMPTON.

The Directors of the Southampton Gaslight and Coke Company present the following report for the year ended Dec. 31, 1928. An interim dividend of 2½ p.ct., *less* income-tax, was paid in August last, and the Directors recommend that a further dividend of 2½ p.ct., *less* income-tax, be now paid, making in all a maximum dividend of 5 p.ct. per annum for the year ended Dec. 31, 1928; they also recommend that £7000 be transferred from profit and loss account to reserve fund. The sales of gas for the year show an increase over 1927 of 71,201,100 c.ft., or 5·39 p.ct.—the total sales being 1,391,881,800 c.ft. Reductions in the price of gas, amounting in all to 7d. per 1000 c.ft., were made in April and October. The calorific quality of gas supplied has been maintained above the declared value.

SOUTHEND-ON-SEA.

The report of the Southend-on-Sea and District Gas Company for the half-year to Dec. 31, 1928, states that dividends are declared at the same rates as for the first half-year—viz., £6 and 5½ p.ct. on the preference, and £6 12s. 6d. and £6 5s. p.ct. on the ordinary stocks respectively.

TENBY.

The Annual Meeting of the shareholders of the Tenby Gas Consumers' Company was held on March 21; Mr. E. H. Leach presiding in the absence of the Chairman, Mr. G. Chiles. A dividend was declared at the rate of 7 p.ct., *less* tax, for the year.

WILMSLOW AND ALDERLEY EDGE.

In the Directors' report of the Wilmslow and Alderley Edge Gas Company for the year ended Dec. 31, 1928, a dividend at the rate of 10 p.ct. on the old shares and 7 p.ct. on the new shares is recommended.

ANTIQUATED LEGISLATION.

Lord Astor at Plymouth.

Speaking at Plymouth on Thursday, March 14, Lord Astor said that he discovered, when addressing meetings last autumn, that there was a grievance affecting the gas industry. He made personal inquiries in Plymouth and in London, and came to the conclusion that there was a real grievance, that it could be put right, and that it ought to be put right. The gas industry was suffering because it was governed by certain antiquated laws passed nearly a hundred years ago.

A century ago, when gas was first used, there was no electricity. In those days gas was used for lighting only, and it was a monopoly. The Parliament of the day was afraid that unless restrictions were put upon the industry it would develop in a way prejudicial to the consumers. Various Acts were passed to prevent the community being exploited by the industry. These Acts might have been necessary in the middle of the last century; but since then things had greatly altered, and the restrictions were now out-of-date and operated unfairly against the industry. Gas was no longer a monopoly, and to-day it was used by 35 million people. The general public might get a better service, and the gas industry might be helped if these unjust restrictions were removed. Therefore he decided to raise the matter in the House of Lords. The answer he got at first was unsatisfactory. The reply was that many of the points were controversial, and that there was no time to pass amending legislation. However, in order that something might be done straightaway, he suggested that the Government should introduce a Bill dealing with the non-controversial points of the gas question, leaving the controversial points to be dealt with in the next Parliament. He continued to press this in private conversation, and he was glad to say that as a result the Government introduced recently a Bill which the gas industry said would put right many of the injustices. There was no opposition to the Bill, and he hoped it would get through the House of Lords in a few days. Whether it passed the House of Commons afterwards depended upon whether the Labour Party opposed it or not. He hoped they would not, and that within a few weeks the situation would be eased by the Bill being passed.

Mr. W. J. Walters, who presided, thanked Lord Astor for his work on behalf of the industry.

SHEFFIELD GAS COMPANY.

Annual Co-Partners' Dinner.

The annual dinner of the co-partners of the Sheffield Gas Company was held at the Cutlers' Hall, Sheffield, on Friday, March 22. There were about 450 present, representative of every department in the Company; Mr. RALPH HALKETT, the General Manager and Secretary, presided.

Councillor C. W. GASCOIGNE, proposing the toast of "The Chairman," recalled the fact that when Mr. R. Halkett joined the Company the shares were standing at a low figure. It had been rescued from that, and now was recognized in municipal, Government, and stock-holding circles as one of the best companies in the country. The Chairman had had a large share in bringing this about. Then too, since he came, the employees no longer ranked as servants, but had a living interest in the Company. He was looking forward to the time when they would have representation on the Board of Management. Their advent on the Board would not be for its destruction, but its prosperity.

Mr. H. DRONFIELD supported the toast.

Mr. R. HALKETT, replying, said that six years ago the Sheffield Gas Company inaugurated the co-partnership scheme, and Colonel H. K. Stephenson went to the various works and explained the scheme. The principal object was that out of a share of the profits of the Company each employee should have a certain amount allotted to him, invested in the Company to form a fund from which he could draw when incapacitated from work or in particular need. Anticipation of such times had blighted a man's enjoyment of life in years gone by, but by the introduction of the co-partnership scheme it was hoped to remove such blight. They all appreciated the fact that, without any drain on the wages earned, a certain amount of provision for a rainy day was accumulating as a result of their daily labour. As co-partners their well-being varied with the fortunes of the Company. In working for the Company they worked for themselves.

A musical entertainment followed, provided by employees of the Company.

IMPERIAL CHEMICAL INDUSTRIES, LTD.

Directors' Report.

The Directors of Imperial Chemical Industries, Ltd., announce that the profit for the year 1928 amounts to £5,488,243, representing an increase on 1927 of £921,018. With the £82,680 brought forward from 1927, the total profit available is £5,570,923. Out of this sum the Directors have decided to transfer £1,000,000 to general reserves, £275,540 to income-tax account, and to carry forward to 1929 £109,633, leaving £4,185,750 available for distribution to the shareholders. After providing £1,194,550 for the dividend on the preference shares, there remains £2,991,200 for the ordinary and deferred shareholders. An interim dividend of 3 p.ct. on the ordinary shares was paid on Dec. 1, 1928. The Directors have therefore decided to recommend a final dividend on the ordinary shares of 5 p.ct. (actual), making 8 p.ct. for the year, and a dividend on the deferred shares of 1¾ p.ct. (actual), both *less* income-tax, at the standard rate of the year 1929-30, payable on June 1, 1929.

In accordance with the terms of the circular to the shareholders dated June 14, 1928, the new issue of ordinary and deferred shares will rank for this dividend from July 1, 1928, calculated on the amount per share by way of capital credited as paid up and from the due dates of the instalments. The final dividend on the new ordinary capital at the rate of 5 p.ct., and the dividend on the new deferred capital at the rate of 1¾ p.ct. for the part of the year will therefore be satisfied by the payment of dividends of 4·478688d. gross per ordinary share of £1 and 0·862090d. gross per deferred share of 10s.

During 1927 and 1928 a considerable appreciation took place in the value of investments held by the Company's subsidiaries, part of which has been transferred to the Company through distributions of assets on liquidations. After making certain appropriations out of the realized surplus so arising, including writing off the whole of the preliminary expenses of £1,260,953, the reserves of the Company at Dec. 31, 1928, including the transfers made thereto last year, and share premiums, will exceed £11,000,000, as compared with £700,000 at Dec. 31, 1927.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Abnormal conditions have again ruled on this market during the past week, and demand has been considerably in excess of available supply. Collieries still complain of short outputs due to influenza among the miners, but this is improving. Quite exceptional numbers of boats have been waiting in the river for loading turns, and the delay has been considerable. It is difficult to judge to what extent the present conditions are to be regarded as abnormal, and how much represents real improvement in trading. Good sales have been made for the whole of April, and outputs are well booked for the month, but beyond that consumers are not anxious to operate.

In the general anxiety to complete shipments before the Easter Holidays, prices have been just anywhere, and collieries which have had odd lots to sell have in some cases been able to name their own figure, especially in the case of coking coals and best Durham bunkers.

Gas coals have been in good demand, and Wear Specials are nominally 16s. 6d. to 17s. f.o.b. Best qualities quote 15s. 6d., and seconds 15s. to 15s. 6d. Coking coals have been anything for prompt, but may perhaps be put at 16s. to 17s. nominal for forward. Best Durham bunkers likewise are practically unobtainable for early shipment, while seconds are quoted at 16s.

Gas coke for shipment is 20s. 6d. to 21s. f.o.b.

YORKSHIRE AND LANCASHIRE.

Although the output at collieries has increased slightly as the result of the reduction in the number of absentee miners owing to illness, production has not yet overtaken demand, and there is difficulty in obtaining prompt supplies of large steams, and also some of the washed grades. On export account delay continues in regard to prompt supplies, and values up to 20s. per ton f.o.b. are easily maintained, while in respect to secondary descriptions the position at the individual collieries is a dominating factor in regard to prices. For anything like prompt business, a considerable increase is still being paid. The industrial market is steady, with recent values maintained.

The following are the Humber bunker and export prices f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 21s. 9d., export 19s. to 20s.; screened gas coal, export 18s.; washed trebles, export 19s.; washed doubles, bunkers 19s. 9d., export 18s. to 18s. 6d.; washed singles, export 16s. 6d. to 17s.; washed smalls, bunkers 15s. 9d., export 12s. to 12s. 6d.; rough slack, bunkers 14s., export 12s.; smithy peas, export 18s. to 18s. 6d.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 18s. 9d., export 17s. 6d.; screened gas coal, export 17s. 6d.; washed trebles, export 18s.; washed doubles, export 17s.; washed singles, export 16s.; washed smalls, bunkers 14s. 9d., export 11s. 9d. to 12s.; unwashed trebles, export 17s.; unwashed doubles, export 14s. 6d. to 15s.; rough slack, bunkers 14s., export 10s.; coking smalls, export 10s. 6d.

Derbyshire and Nottinghamshire—Top hards, bunkers 20s. 9d. to 21s. 9d., export 19s. to 20s.; cobbles, export 18s. to 19s.; washed trebles, export 18s. 6d.; washed doubles, export 17s. to 17s. 6d.; washed singles, export 16s. 6d.; washed smalls, bunkers 15s. 3d., export 12s.; unwashed doubles, export 16s.; rough slack, bunkers 13s. 6d., export 11s. to 11s. 6d.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 19s. to 20s., export 16s. to 18s.; gas coke, export 20s. to 24s.; furnace coke, export 21s. 6d. to 22s. 6d.

MIDLANDS.

The market has now assumed a more equable tone again. There is no longer any impediment to smooth distribution. The only arrears remaining over from the rush of February are in the house coal department. Some high grades which were specified on a scale disproportionate to output have yet to be delivered. Comparatively few cancellations have been notified since the milder weather relieved the extreme tension of the market. With the emergency over, some London orders which could not be executed have been countermanded, but the tonnage involved is not very big.

Collieries which sharply advanced their prices during the crisis as the only means of stemming an avalanche of orders which could not be coped with have now reverted to the rates previously ruling. With few exceptions, values are at about the January level. In certain descriptions of house coal there is a very perceptible seasonal waning already. The market for industrial grades is free from strain. Both "D.S." nuts and slacks have an easier tendency.

Coke is in short supply. There does not seem to be any early prospect of production being commensurate with demand. Bids of 15s. upwards at ovens for prompt supplies of furnace coke elicit no response. Lincolnshire smelters are propounding a scheme whereby a fixed relation would be established between coke and pig iron prices on the sliding-scale principle. In other districts the proposal is regarded as chimerical.

With the end of the quarter some contracts for gas coal are due for renewal. Negotiations have proceeded with recognition of the stronger position of the seller as compared with 1928. It does not appear, however, that collieries are able to improve on the advance of 6d. or 1s. which they obtained at the turn of the year.

A series of cookery demonstrations was given at the Bradford Mechanics' Institute from March 4 to 9 inclusive by Miss H. H. Tuxford, M.C.A., under the auspices of the Bradford Corporation Gas Department.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *March 25.*

There is a fair amount of inquiry for pitch for next season's shipment, and there are still some buyers for this season. Although there are efforts in some directions to further discount the price, sellers' ideas are not below 35s. per ton f.o.b.

The export price of creosote is unchanged at about 6¾d. to 6¾d. per gallon f.o.b. London.

Tar spirits continue steady as follows: Pure benzole, 1s. 11d. to 2s. per gallon; pure toluole, 2s. 1d. to 2s. 2d. per gallon; and 95/160 solvent naphtha, about 1s. 7d. to 1s. 8d. per gallon.

Pyridine bases is about 4s. 3d. per gallon.

Tar Products in the Provinces.

March 25.

There is no business of interest to report.

The average prices of gas-works products during the week were: Gas-works tar, 18s. to 23s. Pitch—East Coast, 31s. 6d. to 32s. 6d. f.o.b. West Coast—Manchester, 26s. 6d. to 27s.; Liverpool, 28s. 6d. to 29s. 6d.; Clyde, 28s. 6d. to 29s. 6d. Toluole, naked, North, 1s. 7¾d. to 1s, 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3¾d. to 1s. 4¼d. Heavy naphtha, North, 1s. to 1s. 0¼d. Creosote, in bulk, North, liquid, 3¾d. to 4⅛d.; salty, 3¾d. to 3⅞d.; Scotland, 3⅞d. to 4⅛d. Heavy oils, in bulk, North, 6d. to 6¼d. Carbolic acid, 60 p.ct., 1s. 10d. to 1s. 10½d. prompt. Naphthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	1 0	to 1 1	per gallon at works
Motor ,, . . .	1 7	,, 1 8	,, ,,
90 p.ct. ,, . . .	1 9	,, 1 10	,, ,,
Pure ,, . . .	2 0	,, 2 1	,, ,,

TRADE NOTES.

Expanded Metal Company, Ltd.

Intimation has been received from the Expanded Metal Company, Ltd., of York Mansion, Petty France, S.W. 1, that after April 2 the address of their offices will be Burwood House, Caxton Street, Westminster, S.W. 1.

Broadhead Constructions, Ltd.

Owing to the expansion of their business, Broadhead Constructions, Ltd., have taken over larger and more commodious premises. Their new address is: Structure House, 787, Chester Road, Stretford, Manchester.

Dempster-Toogood Verticals at Barrow.

Messrs. Robert Dempster & Sons, Ltd., of Elland, have received instructions to rebuild, after twelve years' working, the bench of Dempster-Toogood continuous verticals at the Salthouse Gas-Works of the Barrow-in-Furness Corporation; and the opportunity is being taken of substituting 95 p.ct. silica for the original siliceous retorts.

"W-D" Verticals for Rugby.

The Rugby Gas Company, on the recommendation of their Engineer and Manager, Mr. R. J. Meiklejohn, have placed an order with the Woodall-Duckham Vertical Retort and Oven Construction Company (1920), Ltd., for an installation of Woodall-Duckham continuous vertical retorts with a daily carbonizing capacity of 93 tons. The installation comprises sixteen 62-in. retorts arranged in a new steel-framed retort house, with brick panelled construction. The contract includes the necessary coal and coke handling plant and a waste-heat boiler.

Gas Chambers and Coke Ovens, Ltd.

Gas Chambers and Coke Ovens, Ltd., incorporating Chamber Ovens, Ltd., have recently been formed with a substantial capital for the purpose of building intermittent vertical chamber ovens, formerly associated with Chamber Ovens, Ltd., and also for the purpose of extending its activities to the building of coke ovens. The Directorate of both Companies consists of the two previous Directors of Chamber Ovens, Ltd., Mr. A. H. Lymn and Mr. N. J. Bowater, as well as Major Basil J. M. Bebb, Managing Director of Messrs. Bernhard Scholle & Co., and Mr. Roy D. Cochrane, Director of the Bartholomew Investment Trust, Ltd.

Tully Plant for Jedburgh.

Messrs. Tully, Sons, & Co., Ltd., of Newark-on-Trent, have received an order from the Jedburgh Gas Company for one of their latest type gasification plant, complete with waste-heat boiler and mechanical operator, capable of making 3000 c.ft. of 380 B.Th.U. gas per hour. The same firm are building two large plants in this country for shipment and erection in France, and have also obtained a contract from the Tarragona City, Spain, to build and equip throughout a Tully gas-works having a capacity of half-a-million c.ft. per day, complete with all the distribution plant, mains, services, meters, stoves, &c. The whole of this plant will be financed and manufactured in England.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 20.]

Nos. 7793—8623.

Ges. fur Linde's Eismaschinen Akt.-Ges.—"Process for breaking up coke oven gas by cooling." No. 8409.

I. G. Farbenindustrie Akt.-Ges.—"Process for washing gas liquors." No. 8485.

Jörgensen, E. H. H.—"Gas cocks." No. 8322.

Maatschappij voor Uityindingen van Dikkers en Bargeboer.—"Gas heating apparatus for liquids." No. 8398.

Mond, A. L.—See I. G. Farbenindustrie Akt.-Ges. No. 8485.

Nicolaisen, J. W.—See Jörgensen, E. H. H. No. 8322.

Schlatter, T.—"Water gas plants." No. 8612.

Simpson, S.—"Dry gas meters." No. 8520.

Sulzer Freres Soc. Anon.—"Installations for dry cooling coke." No. 8588.

Wilson, W.—"Gas producers." No. 8430.

CONTRACTS OPEN.

Coal.

The Rochdale Gas Committee invite tenders for the supply of gas coal. [See advert. on p. 882.]

Gasholder and Steel Tank.

The Rhyl Urban District Council invite tenders for the supply, delivery, and erection of a two-lift spiral-guided gasholder and steel tank. [See advert. on p. 882.]

Pipes and Welding.

The Gas Department of the County Borough of Burnley invite tenders for the supply of steel mains and specials, also for the welding of the mains in position. [See advert. on p. 882.]

Purifiers.

The Gas Committee of the City of Plymouth invite tenders for the supply, delivery, and erection of purifiers. [See advert. on p. 882.]

Colonial Gas Association Dividend.—In their report for the year ended Dec. 31, 1928, the Directors of the Colonial Gas Association recommend the payment of a dividend at the rate of 9 p.ct. per annum, *less* tax, on the ordinary shares for the half-year.

Bognor Stock Issue.—The tenders for the £35,000 new consolidated stock which Messrs. A. & W. Richards offered on behalf of the Directors of the Bognor Gas and Electricity Company (see "Journal" for March 13, p. 758) were opened on March 21. The issue was more than twice subscribed for at prices ranging from £110 down to the minimum of £102 per £100; the average price obtained being £104 10s. 3d.

A Thousand and One Uses for Gas.—The current edition of "A Thousand and One Uses for Gas" deals exclusively with industrial processes to which gas can be and is applied. The gas industry, reads the foreword, may now rightly claim that no manufacturer considering an operation which involves the application of heat in some form leaves out of his deliberations the question of town gas heating, providing his works are situated within the area of a gas undertaking supplying the commodity he requires at a reasonable price. The paper goes on to deal with some of the many industrial uses for gas in an interesting article by Mr. H. R. Hems, of the Birmingham Gas Department.

Auckland Gas Company Report.—The Annual Meeting of the Auckland (New Zealand) Gas Company was held on Feb. 4; the Chairman of Directors, Sir Geo. Elliot, presiding. In moving the adoption of the report and statements of account, the Chairman said the receipts for gas, residuals, fittings, &c., amounted to £470,708, and were less by £3798 than last year; but against this, the total expenditure, which amounted to £361,137, was less by £7043. The total dividend for the year, amounting to £89,312, was larger by £1962, owing to the last call on contributing shares made in July, 1927, and a further 6451 shares allotted to the Employees' Provident Association. During the past year gas service pipes were laid to 1469 additional consumers, making the total number 47,079. Nearly sixteen miles of mains were laid, making the total mileage 629. A total of 3487 cookers were supplied, making the number 35,925, not including those supplied from other sources. The Directors recommended a dividend for the past half-year at the rate of 8 p.ct. per annum on the £1 fully-paid shares, and proportionate amount on the contributing shares 15s. paid, leaving to be carried forward the sum of £40,282.

The Plymouth City Council is making application for sanction to borrow £15,800 for the provision of new purifiers, and tenders are shortly to be invited for the work.

The Blackpool Gas Committee have agreed to meet a deputation from the Chamber of Trade, at which a proposal for the opening of a gas showroom for the sale of appliances will be considered.

Following an explosion at the meter house of the Ramsgate Corporation Gas-Works, a workman, Frank Lowe, was burnt. The roof of the meter house was carried away and some damage was done to adjoining buildings.

During the week Feb. 11 to 17 the output of gas by the Manchester Corporation Gas Department reached a record figure. No less than 202,550,000 c.ft. were consumed in the area during the period, and on many days the consumption was about 25 p.ct. greater than on the corresponding day of the previous year. Remarkable increases in the sale of coke were also recorded, 70,000 bags being sold during the month of February, as compared with 27,000 during February of 1928.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends, Prev. Hf.Yr	Dividends, Last Hf. Yr.	NAME.	Quotations. Mar. 22.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Feb. 7	5	5	Aldershot 5 p.c. max. C. .	70—75	..	..
412,999	,,	,,	4	4	Do. 4 p.c. Pref. . .	73—76	..	..
1,551,868	,,	Sept. 27	7	7½	Alliance & Dublin Ord. .	99—102	..	99½—100½
374,000	,,	Jan. 10	4	4	Do. 4 p.c. Deb. . .	63—66	..	..
522,655	,,	Mar. 7	7	7	Barnet Ord. 7 p.c. . . .	112—115	..	..
900,000	1	Oct. 11	1/7½	1/4½	Bombay, Ltd.	20/—22/-	..	..
172,500	10	Mar. 7	8½	9	Bournemouth 5 p.c. . . .	12½—13½	..	..
500,050	10	,,	7	7	Do. B 7 p.c. . . .	12½—12½	..	..
439,160	10	,,	6	6	Do. Pref. 6 p.c. .	10½—11½	..	10½
50,000	Stk.	Jan. 10	3	3	Do. 3 p.c. Deb. . .	55—58	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb. . .	74—77	..	..
857,300	,,	Mar. 21	7½	7½	Brighton & Hove 6 p.c. Con.	113—116*	—2	..
571,880	,,	,,	6½	6½	Do. 5 p.c. Con.	99—102*	—2	..
1,287,500	,,	Feb. 21	5	5	Bristol 5 p.c. max. . . .	88½—89½a	—½	..
855,000	,,	Sept. 27	7	8	British Ord.	118—121	+1	120½
100,000	,,	Dec. 20	7	7	Do. 7 p.c. Pref. . . .	115—120	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. .	73—76	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	93—96	..	95
100,000	10	Dec. 6	8	6	Cape Town, Ltd. . . .	8—9	..	..
100,000	10	Oct. 25	4½	4½	Do. 4½ p.c. Pref. . .	6¾—7½	..	..
150,000	Stk.	Dec. 20	4½	4½	Do. 4½ p.c. Deb. . .	73—78	..	..
636,860	,,	Feb. 21	6	6	Cardiff Con. Ord. . .	97—100	..	..
837,840	,,	Jan. 10	7½	7½	Do. 7½ p.c. Red. Deb. .	100—103	..	102½—103
167,150	,,	Feb. 21	5	6½	Chester 5 p.c. Ord. . . .	87½—92½b	..	..
79,185	1	Oct. 11	‡2/-	‡2/-	Colombo Ltd. Ord. . . .	36/—38/-	..	..
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. .	21/—23/-	..	..
375,402	1	Oct. 11	1/9½	1/9½	Colonial Gas Assn. Ld. Ord	24/6—26/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
2,073,280	Stk.	Feb. 21	5	7	Commercial Ord. . . .	98—101	..	98—98½
475,000	,,	Dec. 20	8	8	Do. 8 p.c. Deb. .	56—59	..	..
800,000	,,	Sept. 27	‡1	‡1	Continental Union, Ltd. .	122—127	—1	123—126
100,000	,,	,,	7	7	Do. 7 p.c. Pref. .	123—128	..	126
187,560	,,	Feb. 21	7	7	Croydon sliding scale . .	109—112	..	..
409,100	,,	,,	5	5	Do. max. div. . . .	83—86	..	85½
542,270	,,	Mar. 7	7	10	Derby Con.	112—117e	..	..
55,000	,,	Dec. 20	4	4	Do. Deb.	70—72e	..	..
909,000	,,	Mar. 7	5	5	East Hull Ord. 5 p.c. . .	73—75	..	..
1,002,180	10	Mar. 21	‡4	‡7	European, Ltd.	18½—20½*	—½	18½—20¾
19,705,480	Stk.	Feb. 21	5½	5½	Gas Light & Coke 4 p.c. Ord.	18/9—19/3f	..	18 10½—19/3
2,400,000	,,	,,	8½	8½	Do. 8½ p.c. max. . . .	64—66	..	64—65
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref. .	76—79	..	76—77
5,602,630	,,	Dec. 20	8	8	Do. 8 p.c. Con. Deb. .	58½—60½	..	59—59½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. .	98—101	..	10½
82,500	,,	Mar. 21	7	7	Hastings & St L. 5 p.c. Con.	96—101*	+1	..
265,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	76—81*	+1	80—80½
70,000	10	Oct. 11	‡10	‡10	Hongkong & China, Ltd. .	13—14	..	..
219,300	Stk.	Mar. 7	5½	6	Hornsey Con. 3½ p.c. . .	86—89	..	..
1,976,000	,,	Nov. 8	10	10	Imperial Continental Cap.	375—395	—15	379—402
325,180	,,	Feb. 7	8½	8½	Do. 8½ p.c. Red. Deb.	69—72	..	..
395,349	,,	Mar. 7	7½	8	Lea Bridge 6 p.c. Ord. . .	117—120	..	..
2,145,907	,,	Feb. 21	5½	6½	Liverpool 5 p.c. Ord. . .	94—95b	..	..
600,000	,,	Sept 27	7	7	Do. 7 p.c. Red. Pref.	102—104b	..	128½
165,786	,,	Feb. 21	9	8	Maidstone 5 p.c. Cap. . .	124—129	..	..
63,480	,,	Dec. 20	3	3	Do. 3 p.c. Deb. . .	54—57	..	..
75,000	5	Dec. 6	‡8	‡8	Malta & Mediterranean .	5½—6½	..	..
392,000	—	—	—	—	Metrop't'n (of Melbourne) 5½ p.c. Red. Deb. . . .	100—102	..	..
841,920	Stk.	Nov. 22	‡7	‡5	Montevideo, Ltd.	104—108	+3	107
2,061,312	,,	Feb. 21	5	5½	Newcastle & Gateshead Con.	17/—17/6df	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref. .	72½—73½d	+½	..
491,706	,,	Dec. 20	8½	8½	Do. 8½ p.c. Deb. .	68½—69½d	..	..
131,780	,,	Mar 7	7/1/0	7/1/0	North Middlesex 6 p.c. Con.	105—110	+5	..
900,000	,,	Nov. 22	7	9	Oriental, Ltd.	116—120	..	..
189,190	,,	Dec. 20	7½	8	Plym'th & Ston'house 5 p.c.	108—111	..	..
424,416	,,	Feb. 21	7½	8½	Portsm'th Con. Stk. 4 p.c. Std.	113—118	..	117½
341,446	,,	,,	5	5	Do. 5 p.c. max.	81—84	..	..
2,334,464	1	—	—	—	Primitiva Ord.	31/—33/-	..	31/—32/6
244,500	100	Dec. 3	4	4	Do. 4 p.c. Red. Deb. . .	91—94	..	..
695,000	Stk.	Jan. 24	4	4	Do. 4 p.c. Red. Deb. 1911	78—80	..	..
416,345	,,	Dec. 20	4	4	Do. 4 p.c. Cons. Deb. . .	78—80	..	79—80
150,000	10	Mar. 21	6	6	San Paulo 6 p.c. Pref. . .	8½—8¾*	—¼	..
1,736,968	Stk.	Mar. 21	6½	6½	Sheffield Cons.	106—108e	..	..
95,000	,,	Jan. 10	4	4	Do. 4 p.c. Deb. . . .	74—77e	..	..
90,000	10	June 14	‡3	‡4	South African	4—6	..	4½
6,909,895	Stk.	Feb. 21	5	7½	South Met. Ord.	106—108	..	106½—107½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	109—112	+1	109½
1,895,445	,,	Jan. 10	3	3	Do. 3 p.c. Deb. . .	58—60	..	58½
734,000	,,	Mar. 7	6½	6½	Do. 6½ p.c. Red. Db.	99—101	..	..
91,500	,,	Mar. 7	8½	8½	South Shields Con. . . .	106½—107½d	..	..
1,543,795	,,	Feb. 21	6½	6½	South Suburban Ord. 5 p.c.	107—110	..	..
468,337	,,	Dec. 20	5	5	Do. 5 p.c. Deb.	98—101	..	98—99
647,740	,,	Mar. 7	5	5	South'mpton Ord. 5 p.c. max.	76—78	..	..
131,375	,,	Dec. 20	4	4	Do. 4 p.c. Deb.	73—75	..	..
350,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref. .	100—102	..	101
300,000	,,	Dec. 20	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,375	,,	Mar. 7	—	6½	Tottenham District Ord. .	102—105	+2	102½—104½
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	95—98	..	..
181,355	,,	Dec. 6	4	4	Do. 4 p.c. Deb.	75—78	..	79
239,094	,,	Mar. 7	6⅞	7	Uxbridge, Maidenhead, & Wycombe 5 p.c. . . .	93—98	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref. .	85—90	..	..
80,000	,,	Feb. 21	8½	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. .	147—152	..	..
355,836	,,	,,	7½	7½	Do. B 8½ p.c. .	125—130	..	..
432,585	,,	,,	6½	6½	Do. C and New	102—107	..	104—105
362,000	,,	,,	6½	7½	Do. Wimbledon 5 p.c. .	115—120	..	117—120
98,000	,,	,,	7⅝	7⅝	Do. Epsom 5 p.c. . .	125—130	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref . . .	90—95	..	..
88,415	,,	Dec. 20	8	8	Do. 8 p.c. Deb. . . .	56—59	..	..
284,743	,,	,,	4	4	Do. 4 p.c. Deb. . . .	77—80	..	78½—79
207,500	,,	,,	5	5	Do. 5 p.c. Deb. . . .	97—100	..	..

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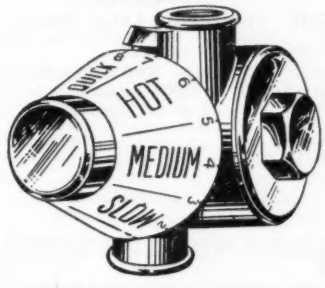

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